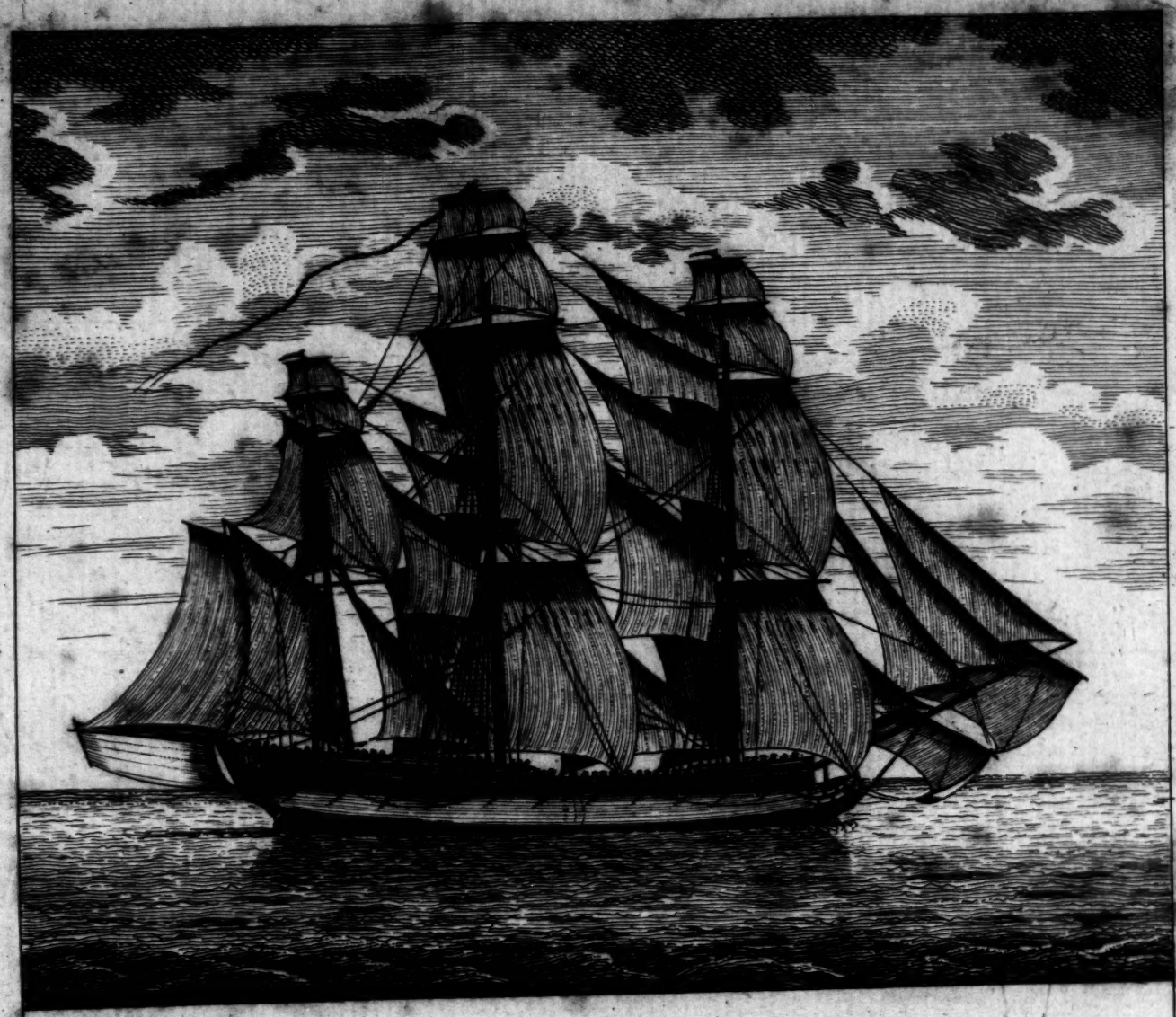


Britannia's Glory first from SHIPS Arose —
To SHIPPING still her power & wealth she Owes
Let each Experienc'd BRITON then Impart
His Naval Skill To Perfect naval Art. —

Billings, Sc.

A

TREATISE

FOUNDED UPON

Philoſophical and Rational PRINCIPLES,

TOWARDS ESTABLISHING FIXED RULES,

For the beſt FORM and

Proportional Dimenſions in Length, Breadth and Depth of Merchant's Ships in General; and alſo the MANAGEMENT of them to the greateſt advantage,

BY

Practical Seamanſhip;

WITH

IMPORTANT HINTS AND REMARKS

RELATING THERETO;

FROM

LONG APPROVED EXPERIENCE.

BY WILLIAM HUTCHINSON, MARINER,
And Dock MASTER at LIVERPOOL.

LIVERPOOL:
PRINTED BY THOMAS BILLINGE, CASTLE-STREET.
M,DCC,LXXXXI.

MVSEVM
BRITAN
NICVM

THIS BOOK

IS MOST HUMBLY DEDICATED,

TO HIS ROYAL HIGHNESS

WILLIAM HENRY,

DUKE OF CLARENCE,

PRESIDENT

OF THAT MOST PATRIOTIC SOCIETY,

INSTITUTED AT *LONDON,*

FOR THE IMPROVEMENT OF

NAVAL ARCHITECTURE,

BY HIS ROYAL HIGHNESS's

MOST HUMBLE SERVANT,

William Hutchinson.

THE

ADDRESS.

THIS Treatiſe on the beſt form for conſtructing merchant's ſhips, and the management of them to the greateſt advantage, by Practical Seamanſhip; *with important hints and remarks relating thereto, is moſt humbly addreſſed to all whom the different parts concern, but more particularly to Owners and Builders of ſhips, young ſea Officers and Pilots, who conſider and conſult what ought and can be done for ſafety and ſucceſs which crowns all, and may be called the foundation on which all our commercial intereſt by ſea depends.*

Although it muſt be allowed, that drafters and builders of ſhips, ſhould be the beſt judges, how to make them anſwer the different trades they may be deſigned for; yet as a ſeaman, I hope to be excuſed pointing out what has appeared to me great defects in practice, not only in the great diverſity of their forms, but in their proportional dimenſions, ſome built too ſhort, or too long, too high or too low, too narrow or too broad, too ſharp or too full in general, or in different parts, that muſt make great diverſities of properties, which cannot be known but by compariſons of fair trials in practice, under the ſame circumſtances. And there certainly muſt be a medium how to avoid the bad properties occaſioned by theſe extremes, which is all that I

pretend

pretend to, endeavouring to deſcribe what I have learned from experience, obſervation, ſtudy, and converſation on theſe important ſubjects. And no doubt, but if learned men of Science were encouraged to make them their ſtudy, but great improvements would be made in them.

A late great Mathematician at Liverpool, Mr. Richard Holden, who found Theory from the Attractive powers of Nature, to agree with my obſervations on the tides, and made a moſt excellent Tide Table from them, as particularly noticed in this book; uſed often to ſay at what we called a Ship Club, that there was no hidden or unknown principles, concerned in the art of building, ſailing, working, and managing of ſhips, but the laws of motion, the preſſure of fluids, and the properties of the lever, which are all well known to Britiſh *Philoſophers, and that nothing was more deſerving their attention and purſuit, in order to bring theſe arts to their utmoſt perfection.*

And our great Sir Iſaac Newton long ago pointed out the Solid of leaſt reſiſtance, which ſhews what might be done if our Philoſophers, Mathematicians, and Mechanicians, in conjunction with profeſſional men, would apply their talents from obſervations and experiments, endeavouring to get general rules from principles, fixed upon greater certainty.

Our famous Philoſophical poet, Mr. Pope ſays, by indirections we find directions out, which has been the rules of my purſuit, and if it was followed by profeſſional men of ſcience, no doubt but all the ſubjects of this book might be brought in time to a regular ſyſtem.

But it is in building ſhips as in the management of them by Practical Seamanſhip, *that men in general are ſo devoted to the modes they have been accuſtomed to, that they cannot be prevailed upon to try any other, whilſt others try impractical methods, and attempt to make ſhips do impoſſibilities ſuch as to back them a ſtern, clear of a ſingle anchor, when the wind is right againſt the windward tide, that drives them*

to

to windward of their anchors; or to back a ſhip with ſails ſo ſet as to prevent her from ſhooting a head towards a danger when laid to, or driving broadſide with the wind right againſt the tide, not knowing that a ſhip driving on either tack will always ſhoot and advance bodily forward the way her head lies, in ſpite of any ſails that can be ſet aback; all which, I truſt, will be ſhewn in their proper places in the following work.

Not only the above inſtances, (by which I have known ſhips to go on ſhore,) but the whole duty and conduct of ſea officers, as far as mentioned in this book, has hitherto been left entirely to the ſlow progreſs of experience, by which means they, and all concerned with them, are conſtantly liable to be great ſufferers from miſtaken practices in ſeamanſhip.

Frequent obſervations of this defect, induce me to endeavour to fix the beſt rules for Practical Seamanſhip, *that ſeamen may not be left entirely to learn their duty by their own and other people's misfortunes, which has been the caſe hitherto, but by the experience of others who have gone before them. From all that I have ſeen, in the many different trades that I have been employed in, the ſeamen in the coal and coaſting trade, to the city of* London, *are the moſt perfect in working and managing their ſhips in narrow, intricate, and difficult channels, and in tide ways; and thoſe in the* East India *trade are ſo on the open ſeas.*

Theſe reaſons, and that the moſt of the uſeful arts have been made public, to our great improvement and advantage, emboldens me to publiſh on this long neglected ſubject, the following ſheets, which are the reſult of much labour and application: but which I muſt own, will appear to great diſadvantage from the unexpected difficulties I have found, in being a new writer, venturing to lead the way on ſo important and extenſive a ſubject, in this learned criticiſing age; but for my imperfections, as a ſcholar, I hope the Critics will make allowance for my having been early in life at ſea as cook of a ſmall collier;

collier; and having ſince then gone through all the moſt active enterprizing employments I could meet with as a ſeaman, who has done his beſt, and who, as an author, would be glad of any remarks candidly pointed out how to improve his defects, if there ſhould be a demand for another Edition.

The following Note *from the* PRESIDENT *of the* Maritime School *on the Banks of the* Thames, *which I received along with a Book of the* Rules *and* Regulations *of that* INSTITUTION, *I have inſerted, more with a view of enforcing the Uſe and Advantages of a Work of this Kind, than from a Motive of Vanity; being ready to acknowledge the Compliment too flattering.*

" Sir Thomas Frankland preſents his Compliments to Mr. " Hutchinſon, and hopes he will approve their INSTITUTION. " He makes their Superintendant read over, with the eldeſt of the " Boys, his Treatiſe on Seamanſhip; which he thinks ſeems as if " written for the Inſtruction of their Maritime School at Chelſea."

" NOVEMBER 30, 1781.

" *N. B.* He wiſhes the officers of the Navy would ſtudy it alſo."

As my beſt Endeavours have hitherto been exerted for the Public Good, without any other Motive; ſo will they be continued, by

The Public's Humble Servant,

WILLIAM HUTCHINSON.

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ERRATA.

PAGE 28, *l.* 1, for page 21, *read* page 22.
Page 36, *l.* 9, from the bottom, for wooo, *read* wood.
Page 38, *l.* 9, from the top, for ſwell, *read* ſmell.
Page 50, *l.* 17, from the top, the word in, dele.
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Page 52, *l.* 4, from the top, for ſhore, *read* ſtore.
Page 56, bottom *l.* for the more equally, *read* more equal.
Page 61, *l.* 2, from top, from the beſt, *read* for the beſt.
Page 84, *l.* 10, from the top, *read* as the wind and weather.
Page 85, *l.* 10, from the top, *read* to make.
Page 87, *l.* 9, from the bottom, for would, *read* ſhould.
Page 100, bottom *l.* for larboard, *read* ſtarboard.

Theſe two lines omitted, page 128, from the top, after 20th line.

" By precept he has us enjoin'd,
" To keep his wonderous works in mind,
" And to &c.

Page 163, *l.* 4, from top, for ſtay-ſails, *read* main-ſtay-ſails, *l.* 8, *read* wared.
Page 210, *l.* 10, from the bottom, for part, *read* port.
Page 217, *l.* 10, from top, for bright, *read* bight.
Page 285, *l.* 3, from the bottom, for his, *read* is.

PRACTICAL SEAMANSHIP.

AS the management of ſhips depends upon the air, or wind, and water, I hope I ſhall be excuſed in taking the liberty to endeavour to explain what I know from experience, or have learned from others, of the properties of theſe fluids, ſo far as they may concern ſhips and practical ſeamanſhip.

On AIR.

IT is enough for our purpoſe here to ſay, that air in motion, which is one of the principal cauſes of the motion of ſhips, is a fluid body, as much as the water they ſwim in. This is proved from many experiments, and may be perceived from what we ſee ordained by the *All Great Author* of nature, in birds, inſects, and all animals that fly, how they float or ſwim, ſteer, and govern their directions through the air by their wings and tails, upon the ſame principles that fiſhes ſwim in water.

AIR is proved by experiment to have its weight *in air* of about ſeventeen grains to a quart, near the ſurface of the ſea, as a quart veſſel from which the air is drawn by an air pump, weighs about ſeventeen grains leſs than when the air is in it; but the air weighs leſs and leſs in proportion as it is higher above the ſurface or level of the ſea: And its property is to buoy up, or raiſe, any matter which, bulk for bulk, is lighter than itſelf; as may be ſeen by ſmoke, ſteam, or vapours, riſing up to certain heights, 'till they come to air that is of the ſame weight with themſelves, where they float, and make miſts, fogs, or clouds, which darken the ſky, and hinder us from ſeeing any conſiderable diſtance about us, till they are diſperſed or ſeparated, or fall in rain, ſnow, &c. Of this property, a moſt ſtriking inſtance has been of late produced, in the invention of the Air-balloons, which have been ſo curiouſly conſtructed as to carry men to vaſt heights and diſtances through the air, even over the ſea from England to France. The weight of air.

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" To keep his wonderous works in mind,
" And to &c.

Page 163, *l.* 4, from top, for ſtay-ſails, *read* main-ſtay-ſails, *l.* 8, *read* wared.
Page 210, *l.* 10, from the bottom, for part, *read* port.
Page 217, *l.* 10, from top, for bright, *read* bight.
Page 285, *l.* 3, from the bottom, for his, *read* is.

PRACTICAL
SEAMANSHIP.

AS the management of ſhips depends upon the air, or wind, and water, I hope I ſhall be excuſed in taking the liberty to endeavour to explain what I know from experience, or have learned from others, of the properties of theſe fluids, ſo far as they may concern ſhips and practical ſeamanſhip.

On AIR.

IT is enough for our purpoſe here to ſay, that air in motion, which is one of the principal cauſes of the motion of ſhips, is a fluid body, as much as the water they ſwim in. This is proved from many experiments, and may be perceived from what we ſee ordained by the *All Great Author* of nature, in birds, inſects, and all animals that fly, how they float or ſwim, ſteer, and govern their directions through the air by their wings and tails, upon the ſame principles that fiſhes ſwim in water.

AIR is proved by experiment to have its weight *in air* of about ſeventeen grains to a quart, near the ſurface of the ſea, as a quart veſſel from which the air is drawn by an air pump, weighs about ſeventeen grains leſs than when the air is in it; but the air weighs leſs and leſs in proportion as it is higher above the ſurface or level of the ſea: And its property is to buoy up, or raiſe, any matter which, bulk for bulk, is lighter than itſelf; as may be ſeen by ſmoke, ſteam, or vapours, riſing up to certain heights, 'till they come to air that is of the ſame weight with themſelves, where they float, and make miſts, fogs, or clouds, which darken the ſky, and hinder us from ſeeing any conſiderable diſtance about us, till they are diſperſed or ſeparated, or fall in rain, ſnow, &c. Of this property, a moſt ſtriking inſtance has been of late produced, in the invention of the Air-balloons, which have been ſo curiouſly conſtructed as to carry men to vaſt heights and diſtances through the air, even over the ſea from England to France.

The weight of air.

On foul air in ſhips

CONFINED air in ſhips deſerves particular notice; it often occaſions diſeaſes, and ſometimes immediate death, as has frequently been the caſe in the pump wells of ſhips of war. Charcoal fires, &c. in cloſe places, are dangerous and ſometimes fatal. Too many people together in cloſe places, and filth and dirt made and ſuffered to continue below, foul the air; therefore every ſeaman who does not know it ſhould be told, that by his common breathing he fouls a gallon of air, and requires a gallon of freſh air to breath in, every minute; ſo that for the preſervation of themſelves, they ſhould not grudge or think much to keep the places where they reſt and ſleep, as clear and clean as things will admit of; and ſhould uſe every method poſſible to keep ſhips clear of bad, tainted, air, which becomes proportionably heavier as it becomes more foul, and, loſing its circulating property, naturally deſcends to, and ſtagnates in, the loweſt vacancies, where it haſtens to corruption every thing that is ſubject to decay, even the ſhip and her materials; and much more ſo the proviſions, which muſt conſequently make unhealthy ſhips.

To get clear of foul air.

FOUL air in ſhips frequently proceeds from their being over crouded with people below, which may prove very fatal. To prevent the bad effects of its lying in a ſhip, I would recommend to keep the pumps conſtantly working (tho' no water in the ſhip) 'till a lighted candle will burn clear in the bottom of the pump-well, where the worſt air lodges, as being the loweſt and greateſt vacancy in ſhips holds; ſince all water pumps, will act the part of air pumps, or ventilators, as it is known that the water would not riſe to the ſucking pumps, if the air was not firſt pumped out of them. And as Guinea ſhips, whilſt the ſlaves are on board, have their large cloſe fire furnace ſtanding nearly over their pump well, how eaſy might a ſhort copper pipe, of about four-inch bore, be made to go into an iron noſle in the ſide of the furnace, and the other end into a lead or wooden pipe of near the ſame bore, that might be carried down into the pump well, by various ways; and as they make their fires for cooking juſt after midnight, which is the time when all the ſlaves are below, and then ventilators are moſt wanted, it is known from experience in ſhips of war, where ſuch like pipes are uſed, that whilſt the fire burns, by its rarefying power, it will draw up and expel a conſtant ſteam of air from the pump well; ſo that by theſe means, the loweſt and fouleſt air may be got out of ſhips, and the freſh air will naturally circulate and take its place.

The preſſure of air

THE power of the air's preſſure on all bodies near the ſurface of the ſea, is computed to be about fifteen pounds weight on every ſquare inch. It preſſes every way in all directions, not only downwards, but ſlanting ſideways, and upwards, as may be ſeen in common, without machines for that purpoſe, by thoſe little round leather ſuckers (as they are called) uſed by boys at play, which when wet, and clapped upon ſmooth ſtones, preſs the air from between the ſtone and the ſucker; hauling upon the ſtring, in the middle it makes a ſmall vac uum, or little hollow ſpace void of air, and the air's preſſure upwards oppoſite to the vacuum, is the power by which the ſtones are ſupported when carried by boys about the ſtreets.

How the air's preſſure may cauſe to ſink ſhips, &c. which ground in mud.

THE preſſure of the air downwards is known and experienced in many caſes, and its bad effects are felt upon ſhips ſometimes when they take out a raft-port, which they think high enough out of the water when the ſhip is afloat; but if ſhe after that grounds, by the tide leaving her upon mud, ſo as to preſs the water from under part of the bottom, the air's preſſure downwards againſt that part in the mud, where there is neither air nor water, will confine the ſhip from riſing out of the mud, 'till the water flows much above her floating mark, and the water may run in at the raft-port and ſink her. And when ſmall veſſels are deep loaded, and lie a-ground upon mud, and eſpecially if their bottoms are flat---ſuch as a great number of veſſels are which carry goods up and down rivers---the maſters dread and avoid, as much as they can, laying them in the mud, on account of its ſuction, as it is commonly called, and thought to be, but it is entirely owing to the air's preſſure downwards, acting upon the parts where the air and water are preſſed from under them, that their veſſels are in danger of ſinking, being unable to riſe or float out of the mud, and pieces of ſheathing are ſometimes pulled off ſhips bottoms, from the ſame cauſe, when the water gets between the bottom and the ſheathing, and none between that and the mud. The ſame cauſe will alſo keep wood, or any other thing that will ſwim, and is lighter than water, from riſing; for if their buoyancy don't lift them before the water flows upon them, the weight and preſſure of the water is then added to the air's preſſure downwards to prevent their riſing.

How mud may occaſion people to be drowned.

IF a man, tho' famous for ſwimming or diving, by accident ſhould fall, or, out of bravado, jump into the water to dive, if his feet only reach the mud, and ſink ſo far as to preſs the water from

under them, the preſſure of the air and water downwards, will hold his feet ſo faſt, that all his ſtruggling won't be able to relieve him: The only help that can be given him, is by ſomething that he may graſp or lay hold of with his hands before he loſes his ſenſes, or by a boat-hook, &c. to hook him at all hazard, and to haul him out of the mud.

The air's preſſure is the cauſe of what is commonly called ſuction.

WHAT is commonly or vulgarly termed ſuction, is cauſed by the preſſure of the air, which forces and raiſes the water upwards, in our common ſucking pumps, as they are called, where the working of the boxes and clappers only pumps up the air firſt, and takes off its preſſure downwards from the inſide or bore of the pump; then the air preſſing upon the water in the well, will make it riſe to the height of thirty-three feet above its level, up a pump or pipe, where the power of the air is ſo taken off; and quick-ſilver, which is about fourteen times the weight of water, will riſe to about thirty-one inches in a tube or glaſs pipe, void of air:---And theſe prove a balance, or equal weight to the preſſure of our air or atmoſphere; which air when in its moſt denſe or heavieſt ſtate, will very ſeldom raiſe theſe fluids higher.

On judging of the weather from the weight of air.

BUT the air in our Northern climates is conſtantly varying, and is ſometimes about a tenth part rarer or lighter than at other times, conſequently, when lighteſt, loſes about a tenth part of its power to buoy up any matter that is floating in it, or to raiſe water or quick-ſilver, which laſt then ſtands at its loweſt ſtation in our barometers or weather-glaſſes, at about twenty-eight inches high, on the index where the weather is marked. When the air is in its rareſt or lighteſt ſtate, either the watry particles floating in it will fall in ſnow or rain; or it is made light, by an over charge of elementary fire or ſulphureous particles floating in it, by which I had my ſails ſtuck full of black ſpecks, from the dews falling then upon them, when ſailing upon the coaſt of *Barbary*. This inflammatory matter in the air, probably, is the cauſe of lightening and thunder; for I have ſeen the ſame ſort of black ſpecks on the ſails of ſhips, where they have been ſtruck and torn with lightening; and if rain, ſnow or thunder, does not happen, a ſtorm of wind (as mark'd on the index) is expected to be the conſequence, by the air's flying or ruſhing along with a ſwift motion, from where it is denſe, or heavier, and endeavouring to come to an equality in weight, with the place where it is rare or in its lighteſt ſtate. As the air increaſes in its weight, it preſſes the heavier on the quick-ſilver below, and raiſes it proportionably higher in the tube; and when it comes to twenty-nine inches and a half, the

air

air is then reckoned at the medium or middle ſtate, and there the weather is marked changeable; but when the quickſilver comes to be forced above thirty inches, from that to thirty-one inches, is marked fair, dry, froſt, ſerene weather, &c. as ſuch may be expected, when the air is denſe, or in its heavy ſtate, it then raiſes and buoys up the particles floating in it, to a greater height, where they may be ſeparated ſo as to make the ſky clear of clouds for a time. Theſe are the concluſions which I imagine our philoſophers fixed on, when they endeavoured to conſtruct the barometer, or air weigher, to foretel the different weather that might be expected.

Of the uncertainty of weather glaſſes

BUT, (as a ſailor) I venture to ſay, that the weather often proves very different from what it is pointed out by our weather-glaſſes, or by any other of thoſe improved inſtruments or rules that have been made by later and more accurate obſervers of the air and weather that I have yet ſeen, and I doubt their being of any great ſervice to ſea-faring people; for I have ſeen ſtrong gales with a high weather-glaſs; not only Eaſterly, (which commonly raiſes the quick-ſilver,) but when up at thirty inches, I have known it blow ſtrong Weſterly, with rain and ſnow; I have likewiſe ſeen moderate and fair weather, with the quick-ſilver as low as twenty-eight inches three tenths. I have been in the open ocean, a long way from any land, in moderate and fair weather, ſailing pleaſantly along, when ſuddenly the ſhip has been ſtruck with a ſingle flaſh of lightning: This inflammable matter in the air, like electrical matter, *ſeemed* to take fire at the touch of the ſhip's maſts.

A ſtorm once pointed out by the weather glaſs.

BUT in juſtice to barometers, I muſt own I had once, and but once, the advantage of a true admonition of an approaching ſtorm of wind, from Tampion's portable barometer, which I carried to ſea with me as a weather-glaſs for ſome time; and this happened at the mouth of the Engliſh channel, when about ſeventy veſſels ſailed from the Downs, with a moderate breeze in the S. E. quarter. In the morning after leaving the Downs, I perceived a ſudden fall of the quick-ſilver, from about twenty-nine inches and a half, to about twenty-eight inches and a half; we had then all our ſmall ſails ſet; on this alteration, I ordered all hands to work, and took in our ſmall ſails; got down top-gallant yards, and did all that was thought moſt neceſſary, to prepare for an approaching ſtorm, which came on about eight in the evening,

when

when we were a-breaſt of the Lizard: the wind from being moderate at S. S. E. came ſuddenly to N. N. W. and blowed ſo ſtrong, that though we had no ſails looſe but the fore-ſail in the brails, yet it laid the ſhip more down on her broadſide than ever I knew her, by any ſtreſs or preſſure of ſails. This ſudden change of weather, and of the wind to the oppoſite point of the compaſs, probably proved of bad conſequence to all who were unprepared for it. The next morning we ſaw a Dutch or Daniſh ſhip, floating bottom up, which we ſuppoſed was loaded with timber, and had been overſet by this unexpected ſtorm, taking her a back with all ſails ſet; and the accounts we had afterwards, were, that moſt of the fleet ſuffered damage.

On the defects of a weather-glaſs for ſea ſervice

But I muſt acknowledge a defect in this portable barometer, for ſea ſervice, which is, that the quick-ſilver always kept the ſhips motion up and down, ſo that its height muſt be taken from the medium of that motion; and I never had the opportunity of meeting with the marine barometer, ſuch as was carried to ſea by the great Doctor Halley, and which I judge, from its not being continued in practice, has not anſwered the commendable deſign, of giving ſome certainty of the weather, which ſhips at ſea may expect; which opinion I think further confirmed by the obſervations and remarks made by that greateſt of all Navigators, Captain Cook, *with thoſe improved marine barometers, which he had with him in the voyages he undertook, with a view to explore the world. Yet it muſt be allowed, that the diſcovery of theſe properties in the air or atmoſphere, has proved of great advantage in the management of pumps and ſyphons (or crooked pipes to raiſe water) and in many other uſeful inventions.

* The character of Captain Cook is ſufficiently exemplified by the ſervices he performed, which are univerſally known, and which have ranked his name above that of any navigator of ancient or modern times. His uſeful life was one continued ſcene of activity in an eminent degree. He firſt ſailed in the coal trade from Whitby, ſerving ſeveral years as an apprentice, and continuing afterwards as mate in it. Tho' offered to be made maſter of a veſſel in that employ, he preferred entering (when the war broke out in 1755,) on board the Eagle, a 64 gun ſhip, of which Sir Hugh Palliſer ſoon after took the command; which proved the foundation of the future fame and fortune of our great circumnavigator, who was promoted to the quarter-deck, and ever after patronized by him, with ſuch zeal and attention as reflect high honour on his character. To Sir Hugh Palliſer is the world indebted for having firſt noticed, in an obſcure ſituation, and afterwards brought forward in life, the greateſt nautical genius that ever any age or country has produced.—His life, by a melancholy event which all Europe deplored, was unfortunately cut ſhort; but if we ſhould eſtimate it, by the uſefulneſs of it, by the many active and enterprizing ſcenes in which he was engaged, by the important diſcoveries which he effected, by the greatneſs of his worth, and the fulneſs of his fame, he might be conſidered as having lived very long indeed.

WIND may be ſaid to be only the air moving over the ſurface of our globe, from one place where it is heavier, towards another place where it is lighter, which difference occaſions its different directions; and the ſwiftneſs of its motion, is in proportion to the different denſities of the air in different places, as PROVIDENCE has pleaſed to order it for many valuable purpoſes.

WE call it calm, when the air is without motion; but when the air moves, we call it wind; and its power is calculated to increaſe, in proportion to the ſquare of its velocity or the ſwiftneſs with which it flies, which is at the rate of about ſixty miles an hour, in one of the greateſt ſtorms in our climate, as the ingenious Mr. Smeaton has ſhewn in his table of winds, after he had found out what may be called the fixed ſtandard for wind-mill ſails, from curious experiments, which I have ſeen him make in a cloſe room; for the air though at reſt, or in a calm, will act upon any body that is put in motion, as ſo much wind of the ſame ſwiftneſs. Suppoſe a ſhip launching in a calm to gain a velocity, or run at the rate, of a mile in a minute; at this time, this calm will produce as great an effect on the ſhip, as one of our greateſt ſtorms of a mile in a minute, or ſixty miles an hour, would have had upon her ſtern, when ſhe was faſt upon the ſtocks; and a ſhip launched with the ſame velocity, and in the ſame direction with this ſtorm of wind, would feel it calm, for the time ſhe run as faſt as the wind blowed, as may be noticed, when it happens that ſhips are launched with a briſk wind, and their colours blowing aft, the ſame way they are to run, when they come to a quick motion in launching, their colours fly forward for that time. And when any body is put into ſo quick motion through the air, as not to give the air time to cloſe behind it, in that caſe it makes, in ſome degree, a vacuum, and in proportion to this vacuum, there will not only be the reſiſtance, but the preſſure of the air, acting upon theſe bodies, which may be near fifteen pounds upon every ſquare inch; and this may be the reaſon why ſhips' maſts and yards, ſometimes are rolled away in a calm, when they are put into ſo very quick motion, by a labourſome ſhip's rolling. A ſhip under way in a calm, where there is a ſtrong tide or current, will be affected as if a light air or gentle wind was right againſt her, and in proportion to the ſtrength of the tide or current. As the wind happens to blow with or againſt the tide or current, a ſhip will feel leſs or more wind in proportion to the rate of the tide or current.

WIND in many inſtances is altered from its natural direction, as in a narrow river, that has high land, or high trees, cloſe to the water, on each ſide; there the wind commonly blows either right up or right down the river. When the wind blows right acroſs a river, or right off any high land, or when ſhips are cloſe under high land, when it blows ſtrong, they often feel ſuch guſts of eddy winds in all directions, that their pendants are ſometimes ſeen to be blown right up in the air; in ſuch ſituations, they can't trim their ſquare-ſails faſt enough to any advantage, therefore it is beſt to have the ſquare-ſails cloſe furl'd; and if any ſails can be of advantage, it muſt be the ſtay-ſails, mizen, boom ſails, try-ſails, and ſuch others, as may be worked without laying ſo long aback, as to give the ſhip ſtern-way.

On eddy winds, and how the wind is altered from its natural direction.

A ſhip ſailing cloſe by the wind, one particle, or part of air, drives off the other from the lee or after-leech of the ſail, which turns the wind from its direction for a little time, as may be noticed, by a ſhip's after-ſails being obliged to be trimmed ſharper than her head-ſails, and her enſign not flying above three points to leward, when the ſhip is ſailing near ſix points from the wind.

WHEN ſhips are ſailing quartering, or before the wind, the wind then blows perpendicular to, or right upon the ſails, which makes them bag more, or form a hollow, ſo that the wind when it blows ſtrong, may compreſs the air in the belly of the ſail, into leſs compaſs than its natural ſtate, for air, contrary to all other fluids, has that property, that it may be compreſſed into a very ſmall ſpace, as is known by charging and diſcharging of wind-guns, &c.

On WATER.

WATER is a fluid element about 800 times heavier than air, capable of floating ſhips;—and philoſophers tell us, that the particles or ſingle parts of water are ſo ſmall, that their form cannot be perceived by the beſt microſcopes, or greateſt magnifying glaſſes; but that they muſt be round and ſmooth, from their moving ſo freely one againſt another; and from their eaſily giving way, and opening a paſſage for all bodies moving therein: And particles of water muſt be hard, and touch each other, as it is known from experience, that water cannot be compreſſed, or forced into leſs compaſs than its natural bulk, except in a ſmall degree, by any power or weight that can be employed upon it; and as acting and re-action are equal, and contrary

The properties of water.

contrary to each other, it re-acts as it is acted upon, and its power of preſſure is ſo regular that the ſtandard value of gold is regulated by it, and progreſſively increaſing its power according to its depth.

WATER will float the greateſt or heavieſt bodies that take up more room in water than itſelf, and ſhips, boats, or veſſels, with all they contain in or about them, and all other things that will float in water, are exactly the ſame weight as the bulk of water diſplaced, by the bulk of that part of their bodies actually in the water, and below their ſwimming mark, which is lower down, or higher up, according to the weight, or denſity, of the water they ſwim in; for ſhips are known to ſwim lighter in ſalt water than in freſh, in proportion as the ſalt water is heavier than freſh: Therefore, ſuppoſe a pint of water to weigh a pound, (as it does, or thereabouts, in common,) any thing that will ſwim in water and weigh a pound, put into a veſſel full of water, will diſplace or make run over, its own bulk of water to its ſwimming mark, a pint for a pound. The ſame rule holds good with reſpect to ſhips of the greateſt burden, or to other bodies according to their bulk.

THE power and preſſure of water is known to increaſe according to its altitude, regardleſs of its quantity; for ſuppoſe a tight dock to be made, that would nearly fit to the ſhape of the bottom of one of our firſt rate ſhips of war to her floating mark—half an inch, or the leaſt thickneſs, of water would lift and float this ſhip, as effectually as the whole ocean; for water, like other fluids, preſſes equally in all directions; therefore, the water muſt preſs equally againſt the ſhip, as it does againſt the dock, which muſt conſequently float the ſhip as ſoon as the water comes to the height of her floating mark: And ſuppoſe this dock could be filled with water when the ſhip is out of it, that water would weigh the ſame as did the ſhip when with all her materials then in and about her, and the very ſmall quantity of water which floated her, added to that.

On the preſſure of water and leaks atdifferent depths.

IF a ſhip has the flatteſt part of her bottom lying ſixteen feet deep, (which is often the caſe,) the water then preſſes ſixteen times, as much upwards againſt this flat part, as it does on any part of the ſame ſhip about the water's edge, and ſo on to any other part according to its depth. And ſuppoſe this ſhip to have four leaks, or plug holes, of equal bigneſs, that could be drove out occaſionally, the firſt at one foot under water, the ſecond at four feet, the third at nine feet, and the loweſt at ſixteen feet in the flat part of her bilge; that hole at four feet deep would leak or let in as much water again

in the ſame time, as that at one foot deep; and that at nine feet, three times as much; and that at ſixteen feet, four times as much though it run into the ſhip upwards; and ſo on in proportion to the ſquare root of the height of the water above the leak or plug-hole; therefore leaks in ſhips are more or leſs dangerous, according to their depth under water.

Different ſhaped bottles broke by the waters preſſure.

THE great Doctor Halley ſays, that the preſſure of the water at thirty-three feet deep, which is equal to the preſſure of our atmoſphere,) preſſed the natural air into half its ſpace in his diving-bell. I have tried experiments on the preſſure of water upon bottles of different ſhapes, corked up without any thing in them but common air, making them faſt to a lead-line juſt above the lead; when two common ſquare flat-ſided caſe-bottles, which would hold about three half pints each, broke at the depth of between ſix and ſeven fathom; but two oval formed thin florence flaſks, of nearly the ſame ſize, bore the preſſure to about fifteen fathom deep; and a quart bottle round one way, but having two ſides ſomewhat flattened, bore about fifteen fathom; and a round common quart bottle, broke only at about twenty-eight fathom. At great depths I imagine few things that are made hollow and tight will bear the water's preſſure; I have ſeen an inſtance of its great power, when, my ſhip driving off the bank in Gibraltar-Bay into deep water, our anchors would not reach the ground at a hundred fathom; and when we hove them up, we found our two new nun-buoys had their ſides cruſhed inwards by the water's preſſure.

On waves.

WATER at the ſurface is powerfully acted upon by the wind, and by that according to its ſtrength, which forces the water from its natural level, which it always endeavours to come to, but is prevented and diſturbed by ſeveral cauſes acting upon it. When the water is in motion by a ſtrong tide or current, and the wind blows ſtrong againſt it, it makes the moſt dangerous and troubleſome waves. High waves at ſea are ſuppoſed to move along at the rate of about twenty miles in an hour.

THIS may be called the foundation on which all navigation intereſt may be ſaid to depend. Therefore particular notice ſhould be taken of all veſſels floating in water, from the greateſt ſailing ſhips, to the ſmalleſt rowing and towing boats in ſhoal water, and canals that are now become numerous, and of great advantage to trade in general, both in Britain and Ireland. And canal waters being ſo ſhoal that its particles have not room to recede downwards when preſſed upon by the too full bows of the veſſels going upon them, they ſhould be built ſharp forward like the London wherries that carry paſſengers on the River Thames, when obliged to row in ſhoal water againſt the tide; they ſeparate and divide the particles of water at its ſurface where it has room to recede to each ſide, are not built with flanging full bows that drive a ſwell of water before them that obſtructs their head way. Ships built with too full bows are obſtructed by the ſame natural cauſe, and loſe their ſteerage in proportion as they ſhoalden their water, by ſmelling the ground as it is called by ſeamen.

About the year 1755, I went to Chatham, where I obſerved the Royal Sovereign firſt rate ſhip of war, in the repairing dock, laid upon blocks that formed a convex curve, about two feet higher under her main frame, than at each end of her keel, in order to ſuit her hogged concave bottom, which I reckon was occaſioned by her being built with a long ſtraight floor, which certainly muſt be allowed to make the moſt unnatural, unfair and worſt bottoms for ſhips' to ſail, ſteer, ſtay, or wear well upon; or even for freight ſhips to ſtow cargoes upon, which great defect by all poſſible means ought to be guarded againſt and improved, by building ſhips with convex bottoms curved downward in their length, as deſcribed page

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Obſervations on Ships built with long ſtraight Floors.

THESE floors have been always reckoned to give ſhips every good property, and are formed by having a certain number of floor timbers, exactly of the ſame mould faſtened equally high upon the ſtraight keel in the main body of the ſhip, which are called ſo many dead flats, from whence the other floorings begin to riſe ſharper by degrees, till they ſtand upon dead wood towards the ſtem and ſternpoſt, to form the entrance and run of the ſhip.

The bottoms of ſuch ſhips bend eaſily both ways.

REASON, as well as long ago experience, ſhould have taught us, that this is far from being the beſt method to conſtruct ſhips' bottoms; for, from the time of their being launched, theſe bottoms are very liable to be bent eaſily both ways, either hogging upwards, or ſagging downwards, to dangerous degrees, in proportion as the upward or downward preſſure happens to prevail, without appearing to alter the ſheer of her upper works for a time, till age or accident ſoon fixes the bottoms with a conſtant hog or curve upwards, which not only weakens them greatly, where their upper works are loweſt and weakeſt, but leſſens their holds in the main body of the ſhip, ſo that they ſtow and carry leſs weight there in proportion as their long floors are hogged upwards. This makes one of the moſt unnatural, worſt formed bottoms poſſible, which makes them very defective, as above mentioned; or even to take the ground without damage, as will be proved from facts.

Reaſons why ſuch a Ship's bottom hogs ſo ſoon.

Much leſs preſſure will bend or break any thing flat, than if rouuding outwards.

IT has been long known by experience, and proved experimentally, what little ſtreſs, ſtrain, or preſſure, will bend or break any ſtraight or flat things, or veſſels, in compariſon to thoſe that are made curved, to form a convex arch, rounding outwards, againſt the preſſure and ſtrain that is to act upon them; as may be obſerved in thoſe almoſt flat arches of bridges and vaults, that are built with ſuch ſmall looſe brittle materials, as bricks, lime, &c. what great weight and ſtreſs they will bear upon them without damage.

Further proved by experiments with the air-pump.

IT is well known how little air can be pumped out of any veſſel that is made quite ſtraight or flat ſided, before it is bent or broke by the outward preſſure of the air upon it, in compariſon with thoſe veſſels made convex, or rounding outwards, which, made of very ſlender materials, ſuch as glaſs, &c. will bear the whole preſſure of our air or atmoſphere, (which is reckoned to act with a power of fifteen pounds weight on every ſquare inch of ſurface,) without being hurt. But the firſt natural cauſe that acts upon theſe ſhips' bottoms to hog them is the preſſure of water, the nature of which therefore deſerves particular notice and attention on this occaſion.

I HAVE

I HAVE already obſerved, in the chapter on water, its weight, which is 800 times greater than that of common air, bulk for bulk; and the great power with which it preſſes *in all directions* according to its depth; inſomuch that the air in Dr. Halley's diving bell, at thirty three feet deep, was compreſſed by it into half its natural ſpace. And I have related ſome experiments I made, on the power of the preſſure of water at different depths in breaking glaſs bottles, by which it appeared that thoſe of an oval, or circular make, though thinner, bore a greater preſſure of the water before they burſt.---Theſe experiments ſerve to ſhew, and experience will confirm, how liable theſe long ſtraight floored ſhips are to hog, for the time of their being launched with empty holds. Let us ſuppoſe the middle flat of their floors to be eight feet under water, which preſſes upwards againſt it eight times as much as it does on the parts at the water's edge, when at the ſame time the thin ſharp parts of the entrance and run of the ſhip, occupy ſo ſmall a ſpace in the water, that its preſſure upwards acts very little to ſupport the high, heavy, projecting parts of the head and ſtern in proportion to what it does amidſhips, where ſhips are built loweſt and weakeſt, which muſt tend greately to hog them, till a proportionable weight of ballaſt, materials, or goods is ſtowed there to counter-balance exactly the preſſure of the water upwards upon their floors. Or when improperly ſtowed, or loaded with too much weight cloſe fore and aft, where there is very little bearing body under water to ſupport it, and too little weight in proportion amidſhips, when the flat of the floor may be fifteen feet under water, the water will then preſs upwards againſt it fifteen times as much as it does on the parts at the water's edge, which will act with a power to hog them, in proportion as weight is wanting there to ballance that preſſure.

On water, and its power of preſſure to hog theſe ſhips' bottoms.

On theſe Ships being hogged by taking the Ground.

IN converſation with the advocates for this form of building ſhips, amongſt the many arguments they endeavour to give in their favour, they make uſe of that of their taking the ground to great advantage by their lying upon ſo many level floor timbers to ſupport them. Yet from obſervation I can ſay that whoever takes notice of them when they come a-dry, even upon hard level ground,

or

or carpenter's ways, it may be plainly perceived how much the middle of their long ſtraight floors are hogged upwards. And when they happen to be laid a-dry upon mud or ſand, which makes a ſolid reſiſtance againſt the long ſtraight floors amidſhips, in compariſon with the two ſharp ends, the entrance and run meet with little ſupport, but are preſſed down lower than the flat of the floor, and in proportion hogs the ſhip amidſhips, which is but too well known from experience, to occaſion many total loſſes, or do ſo much damage by hogging them, as to require a vaſt deal of trouble and expence to ſave and repair them, ſo as to get the hog taken out, and brought to their proper ſheer again. And to do this the more effectually, the owners have often been induced, to go to the expence of lengthening them; and by the common method, in proportion as they add to the burden of theſe ſhips, by lengthening their too long ſtraight floors, in their main bodies amidſhips, ſo much do they add to their general weakneſs to bear hardſhips, either on the ground or afloat; for the ſcantling of their old timber and plank is not proportionable to bear the additional burden that is added to them.

But defects of this kind are beſt proved from real and inconteſtable facts in common practice. At the very time I was writing on this ſubject, I was called upon for my advice by the commander of one of thoſe ſtrong, long, ſtraight floored ſhips, who was in much trouble and diſtraction of mind, for the great damage his ſhip had taken, by the pilot laying her on a hard, gentle ſloping ſand, at the outſide of our docks at Liverpool, where it is common for ſhips that will take the ground to lie for a tide, when it proves too late to get into our wet docks. After recommending a proper ſhip carpenter, I went to the ſhip, which lay with only a ſmall heel, yet was greatly hogged, and the butts of her upper works ſtrained greatly upon on the lee ſide, and the ſeams of her bottom, at the lower futtock heads, vaſtly opened on the weather ſide; all which ſtrained parts were agreed upon, not to be caulked, but filled with tallow, putty, or clay, &c. with raw bullock hides, or canvas nailed with battens on her bottom, which prevented her ſinking with the flow of the tide, without hindering the preſſure of water from righting and cloſing the ſeams again as ſhe floated, ſo as to enable them to keep her free with pumping. This veſſel, like many other inſtances of ſhips of this conſtruction that I have known, was ſaved and repaired at a great expence, in our dry repairing docks, as above mentioned. And that their bottoms not only

only hog upwards, but ſag (or curve) downwards, to dangerous and fatal degrees, according to the ſtrain or preſſure that prevails upon them, will be proved from the following facts.

Obſervations on long, ſtraight floor'd Ships, ſtowing and carrying very heavy Cargoes.

IT has been long known from experience, that when ſhips load deep with very heavy cargoes or materials that are ſtowed too low, it makes them ſo very labourſome at ſea, when the waves run high, as to roll away their maſts, and after that misfortune, cauſes them to labour and roll the more, ſo as to endanger their working and ſtraining themſelves to pieces, to prevent which, it has been long a common practice to leave a great part of their fore and after holds empty, and to ſtow them as high as poſſible in the main body amidſhips, which cauſes the bottoms of theſe long ſtraight floored ſhips to ſag downwards, in proportion as the weight of the cargo ſtowed there, exceeds the preſſure of the water upwards, ſo much, ſo as to make them dangerouſly and fatally leaky.

On their loading with rock ſalt.

I HAVE known many inſtances of thoſe ſtrong ſhips of five or ſix hundred tons burden, built with long ſtraight floors, on the eaſt coaſt of England, for the coal and timber trade, come loaded with timber from the Baltick to Liverpool, where they commonly load deep with rock ſalt, which is too heavy to fill their holds, ſo that for the above reaſons they ſtowed it high amidſhips, and left large empty ſpaces in their fore and after holds, which cauſed their long ſtraight floors to ſag downwards, ſo much as to make their hold ſtanchions amidſhips, at the main hatchway, ſettle from the beams three or four inches, and their mainmaſts ſettle ſo much as to oblige them to ſet up the main rigging when rolling hard at ſea, to prevent the maſts being rolled away, and they were rendered ſo leaky as to be obliged to return to Liverpool, to get their leaks ſtopt at great expence. And in order to ſave the time and expence in diſcharging them, endeavours were made to find out, and ſtop their leaks, by lying them aſhore dry on a level ſand, but without effect, for though their bottoms were thus ſagged down by their cargoes when afloat, yet, when they came adry upon the ſand, ſome of their bottoms hogged upwards ſo much as to raiſe their

mainmaſts and pumps ſo high as to tear their coats from their decks, ſo that they have been obliged to diſcharge their cargoes, and give them a repair in the repairing dock, and in ſome to double their bottoms, to enable them to carry theſe cargoes with ſafety, ſtowed in this manner. From this cauſe I have known one of theſe ſtrong ſhips to founder.

AMONGST thoſe ſhips which have put back to Liverpool to get their leaks ſtopt, there was a very ſtrong looking ſhip belonging to Whitby, with a brave reſolute commander, who told me in converſation, that when his ſhip's leaks were ſtopt, he did not doubt but to be able to beat a paſſage out of our deep bay even againſt weſterly winds; not conſidering, that though his ſhip was made tight by being new calked, yet ſhe carried the ſame defects with her to ſea the ſecond time, where they kept beating to windward againſt weſterly winds till the ſhip foundered, when the worthy commander and his brave crew were obliged to take to their boats and attempt to ſave themſelves, but unfortunately they all loſt their lives in endeavouring to land upon the lee ſhore.

MANY other ſhips have met with loſs and damage from the ſame cauſe of loading rock-ſalt too high amidſhips, but two in particular. One that proceeded to ſea on her voyage ſince this laſt mentioned, foundered, but the crew fortunately ſaved themſelves in their boats. The other when loaded in one of our wet docks, became ſo very leaky that they thought it muſt be ſome ſtone in the dock that had damaged her bottom, they diſcharged and put her into one of our repairing docks, but found no other cauſe but what I told the captain aroſe from her bottom being over ſagged down, and it would be the ſame again if he ſtowed the cargo in the ſame manner, but he ſaid he would take no more in than would ballaſt her.

On their loading with lead.

AMONGST the many inſtances of ſhips that have been diſtreſſed by carrying cargoes of lead, one ſailed from hence bound to Marſeilles, which was ſoon obliged to put back again in great diſtreſs, having had four feet water in the hold, by the commander's account, owing to the ſhip's bottom ſagging down to ſuch a degree as made the hold ſtanchions ſettle ſix inches from the lower deck beams amidſhips; yet it is common with theſe long ſtraight-floored ſhips, when theſe heavy cargoes are diſcharged that make their bottoms ſag down, then to hog upwards, ſo that when they are put into a dry repairing dock, with empty holds, upon ſtraight blocks, they commonly either ſplit the blocks cloſe fore and aft, or

damage

damage their keels there, by the whole weight of the ſhip lying upon them, when none lies upon the blocks under the flat of their floors amidſhips, that being hogged upwards; which was the caſe of this ſhip's bottom; though ſagged downwards ſix inches by her cargo, it was now found hogged ſo much that her keel did not touch the blocks amidſhips, which occaſioned ſo much damage to the after part of the keel, as to oblige them to repair it; which is commonly the caſe with theſe ſhips, and therefore deſerving particular notice.

Thoſe facts prove the neceſſity of having and obſerving nicely what I call a ſhip's form gage, which will be recommended and deſcribed hereafter.

On long ſtraight floored Ships going into repairing Docks.

I HAVE known many inſtances of hogg'd bottom'd ſhips like this laſt mentioned, that have been ſtrained and hurt by being laid upon ſtraight blocks, or elſe have ſplit the blocks under the fore and after part of the keel. Some even have been obliged to dock the ſecond time, and to have the blocks laid with the ſame convex curve that the hog of the bottom and keel has acquired. And we have ſeveral ſhips belonging to Liverpool, that are obliged to have their blocks laid in this manner, according to the known fixed hog of their bottoms.

To prevent the neceſſity of laying blocks for hogged ſhips in a convex manner as laſt mentioned; I lately ſaw an inſtance of a large long floored ſhip of about 700 tons, that had a good ſheer in her upper works, but her bottom and keel amidſhips was hogged about eight inches in the middle of her long floor, and they had cut away the firſt keel from eight inches deep amidſhips, by a ſtraight line to nothing, fore and aft, and had put a proper ſtraight keel below it, which made her ſit fair and eaſy upon the ſtraight blocks.

THESE important and deſtructive facts, muſt be allowed to deſerve particular notice, and our utmoſt endeavours ſhould be uſed to prevent as much as poſſible, the damage done by our ſhips' bottoms hogging upwards; and the dreadful diſtreſſes and loſs of ſuch valuable lives and property occaſioned by their bottoms ſagging downwards; which in my opinion is entirely owing

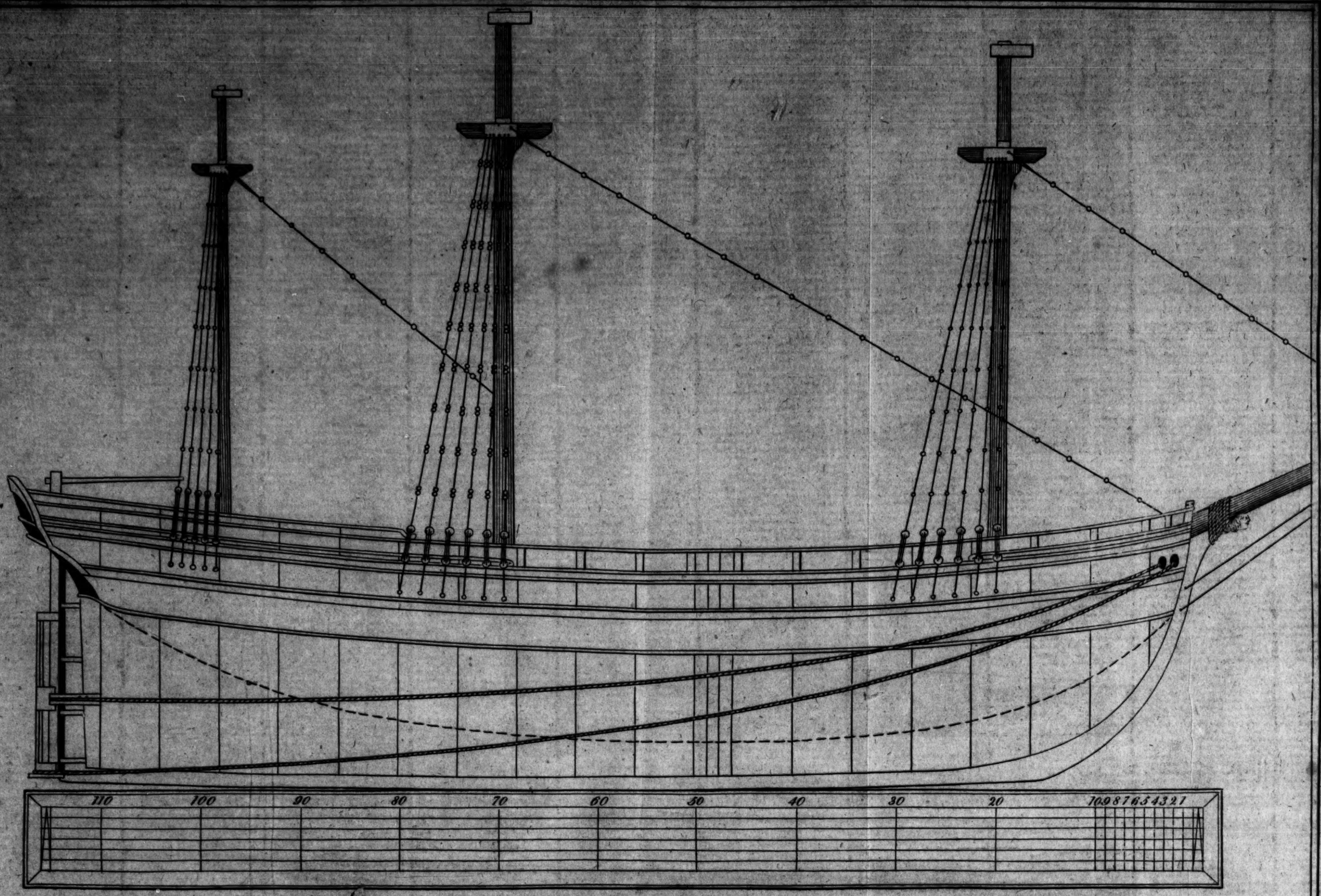
to the common, but deſtructive methods of building, and ſtowing them with very heavy cargoes or materials, as has been mentioned. And firſt to prevent our ſhips' bottoms from hogging and ſtraining ſo much upwards, I recommend to build them with a ſmall curve lengthways in their bottoms, rounding downwards, convexly.

To build Ships with bottoms to form an arch downwards.

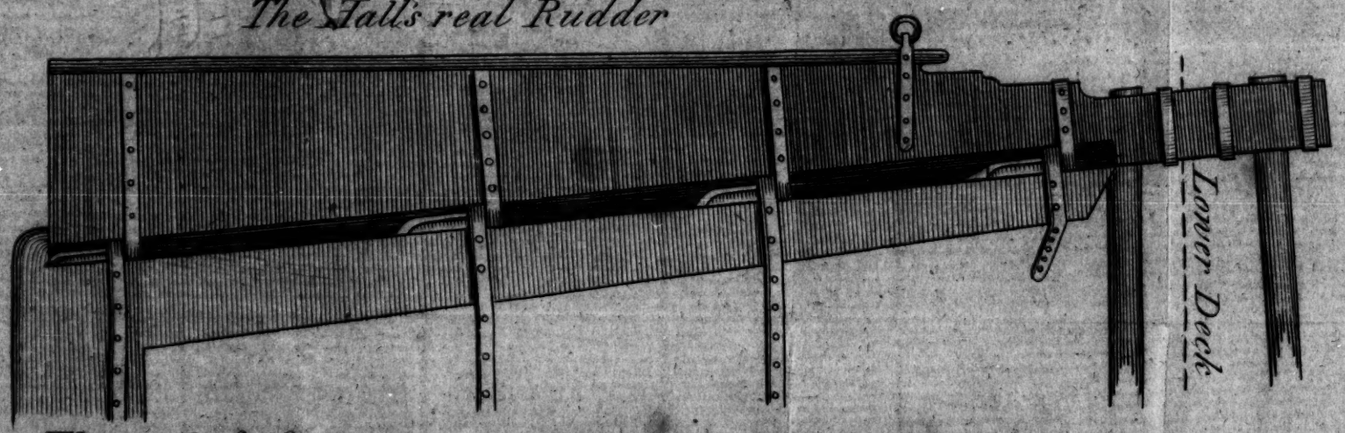
I HOPE enough has been ſaid to make it appear evident to every reaſonable and diſcerning man, that whether ſhips are deſigned to be built with flat floors and floorings for ſtowing or carrying great burdens, or ſharp ſhort floors and floorings, for ſailing faſt, they ſhould all be built with their floors and bottoms lengthways, to form an arch with the projecting part downwards, which will naturally not only contribute greatly to prevent their taking damage by their bottoms hogging and ſtraining upwards, either aground or afloat, as has been mentioned, but will, among other advantages, be a help to their ſailing, ſteering, ſtaying, and wearing; for it is well known that water acts and reacts, by its preſſure, exactly oppoſite, on certain principles, in proportion as it is acted upon, ſo that when any body of a convex form, though heavier than water, is forced with great velocity, in a ſlanting direction, into the water, when its ſurface is ſmooth, the reaction of the water will make it riſe out of it into the air ſeveral times, and make what is commonly called, ducks and drakes. Even a round iron cannon ball, though eight times heavier than its bulk of water, when ſhot in that ſlanting direction into the water will rebound, and riſe out of it, and make ducks and drakes before it ſinks, nearly as far as the range of *one* ſhot from a ſmall elevation. And that cannon ſhot will rebound, and riſe about a man's height out of the water, I can aver for a fact; having had a narrow eſcape ſtanding in a boat's ſtern-ſheets, going to attack a ſhip. I ſaw the ſhot firſt graze the water right a head of us, and then riſe and go directly over our heads, and make ducks and drakes right a ſtern of us.

AND no doubt but water will act with the ſame natural principles upon ſhips that have their bows and entrance formed with circular convex curves, and their floors to form an arch downwards in the length of their bottoms, as recommended, and repreſented

PLATE 11th



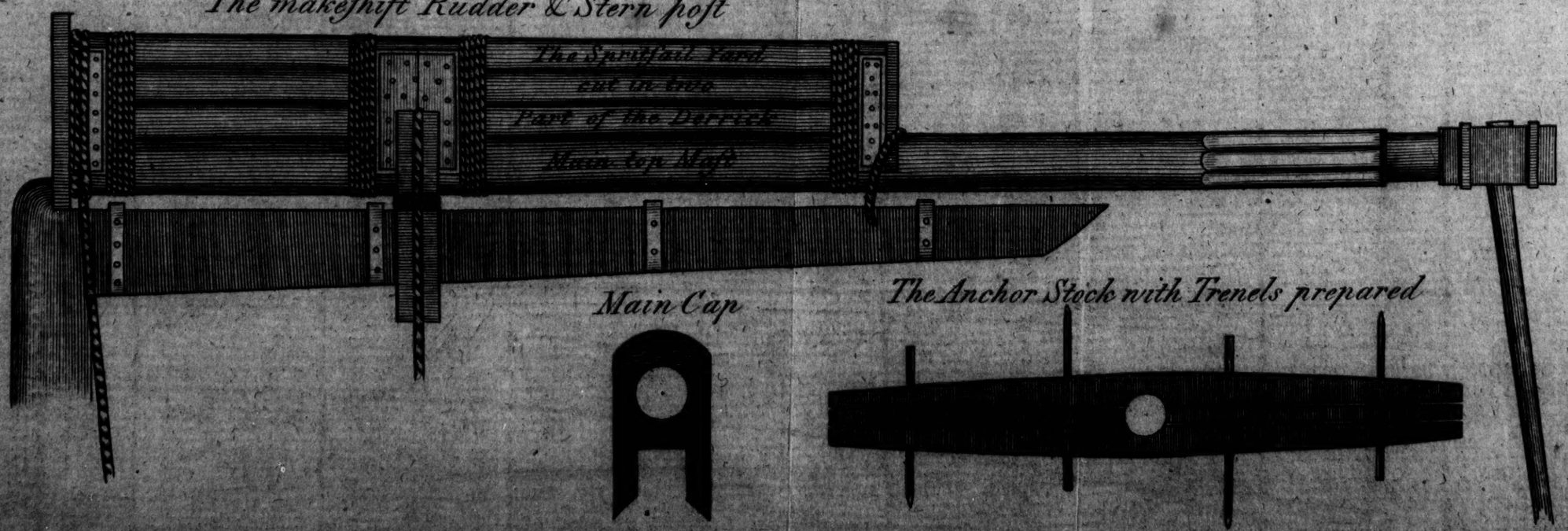
The Tall's real Rudder



Quarter Deck

Lower Deck

The makeshift Rudder & Stern post



Main Cap

The Anchor Stock with Trenels prepared

preſented Plate the firſt, ſo that when they are forced forward through the water with a ſwift progreſſive motion by great preſſure of ſail, *that*, dividing and ſinking the particles of water for the fore body of the ſhip to make a paſſage through them, the reaction of the water, as above obſerved, will tend to lift and lighten upwards the bodies of ſhips thus formed, and thus leſſen their reſiſtance through the water, which muſt help their ſailing, and prevent greatly their bows being plunged deep into the waves, when obliged to carry a preſſing ſail in bad weather. And the water will act, as obſerved page 13, with its power of preſſure upwards greateſt againſt the loweſt part of theſe ſhips' bottoms, under the midſhip, or main frame, which is the main body of the ſhip, where, the center of the greateſt cavity, and the center of gravity of the ſhip and all that ſhe contains in and about her, as well as the center of all her turning motions, which muſt naturally contribute to make her more manageable to ſteer, ſtay or ware to the greateſt advantage. And theſe are very important properties for a ſhip to have; eſpecially the laſt, which is moſt wanted in times of greateſt danger:---when ſhips will not ſtay, to ware readily may be the ſaving of the whole.

Other advantages attend theſe bottoms: by working the keel with a curve downwards on the upper part, it admits of the floor timbers to lie ſo much farther fore and aft upon the keel without deadwood and chocks under them, to form the entrance and run of the ſhip in a more natural, eaſy, ſimple manner, to make her ſtronger and more buoyant, to ſtow and carry more with leſs timber, iron, and workmanſhip; conſequently they may be built cheaper and better than ſtraight floored ſhips can be.

And this form for ſhips' bottoms ſeems pointed out to us by the All-perfect Author of nature: for all flat and ſtraight parts in the main body of a ſhip offend the eye and diſguſt us, when that agreeable curve or ſheer of a handſome ſhips bends and upper works pleaſes, and makes us ſay that ſhe ſwims like a duck upon the water. And all the ſwifteſt fiſh we ſee in motion at ſea, as well as the fowl which ſwim and dive in water for their prey and ſubſiſtence, have all their bellies (which may be called their bottoms) formed with a curve rounding downwards, till paſt their main breadth, as here recommended for ſhips' bottom, where, I reckon, the reſiſtance of the water ceaſes with its tendency to lift the ſhip's fore and main body (as before mentioned), after which it may eaſily be perceived that the water, which muſt riſe and cloſe upon the

tapered after-body and run of the ſhip by its preſſure to come to its natural level again, muſt act with its power to help a ſhip forward in her progreſſive motion through the water, in proportion as it is well formed for that purpoſe, which will be noticed hereafter.

THAT theſe curved bottoms will have the advantage in ſailing, is further confirmed by the practice of building all our famous ſailing, ſmuggling and cruiſing cutters, at Folkſton, upon this principle; and, in my opinion, they carry this curve of the bottom to an extreme. We had one built for a privateer at Liverpool, of ſixteen nine pounders, by a draft of one of the moſt famous-ſailing cruiſing cutters in the King's ſervice. She had not only the curve of her ſharp floor in her bottom, but her keel, 58 feet long under her main frame, was curved downwards 8 inches, ſo that they were obliged to lay the blocks for her with the ſame concave curve in the dry dock, to ſheath her with copper after ſhe was launched.---My opinion of this bottom was aſked by the ingenious drafts-man. I told him that the curve of her bottom and keel was carried to an extreme; for in caſe of coming aground and adry, as all veſſels are liable to in our tide ways, ſhe would naturally ſtrain for the want of the neceſſary ſupport of her keel upon the ground fore and aft; and this, and the great rake of her ſternpoſt were the two things that I diſliked. He anſwered this was done to make them ſure and quick in ſtaying in very little room, which muſt be allowed would help that neceſſary property for ſmuggling veſſels, and thoſe that are to cruiſe after them in dangerous narrow channels, creeks, and corners where they frequent: but this property is not ſo neceſſary to a veſſel that is to cruiſe in the open ſea, therefore a ſtraighter keel below, and an upright ſternpoſt, would certainly have been an advantage to her. The friendly debate was concluded by his obſerving, that he was not at liberty to deviate from the draft of the famous-ſailing veſſel above mentioned.

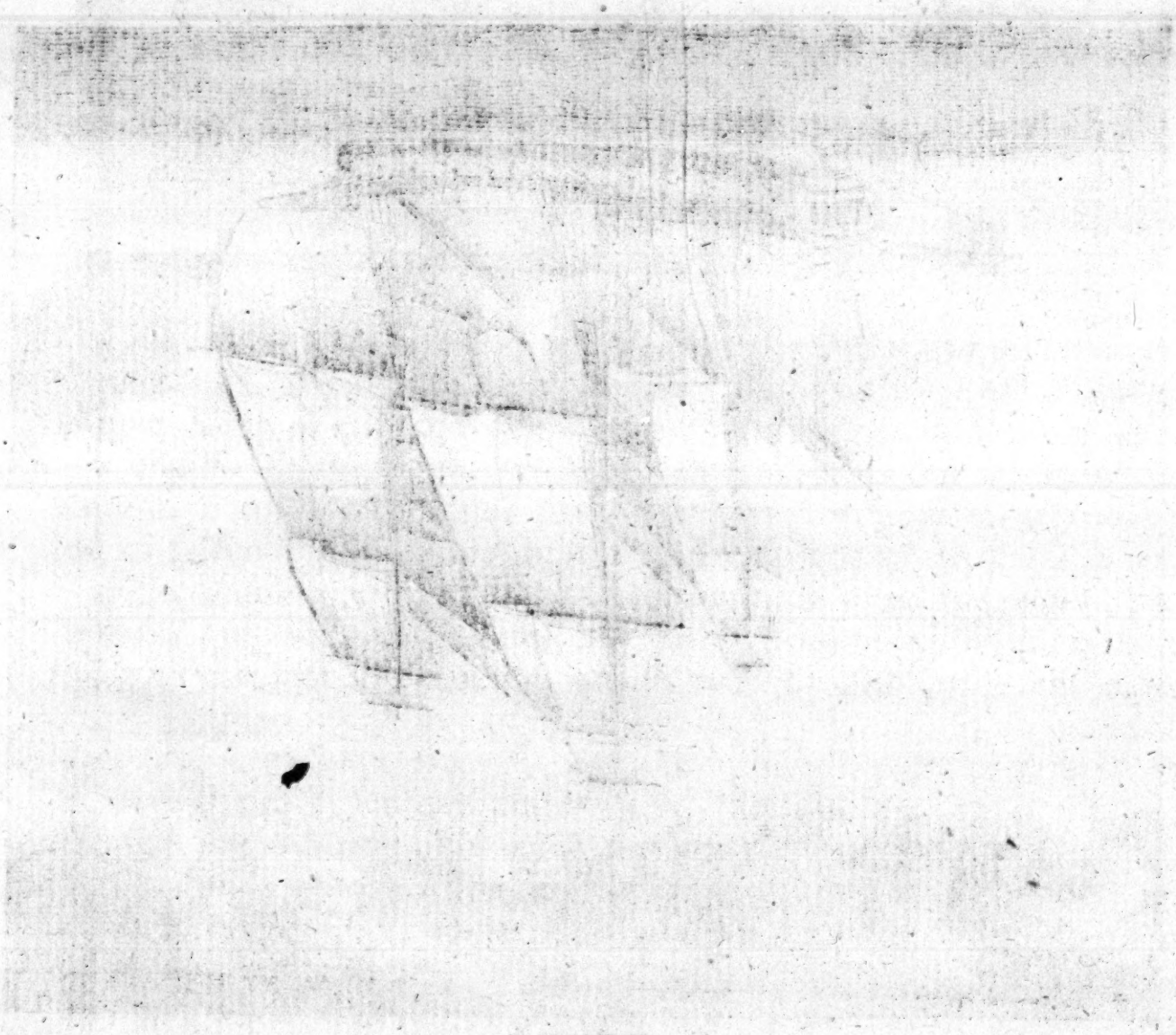


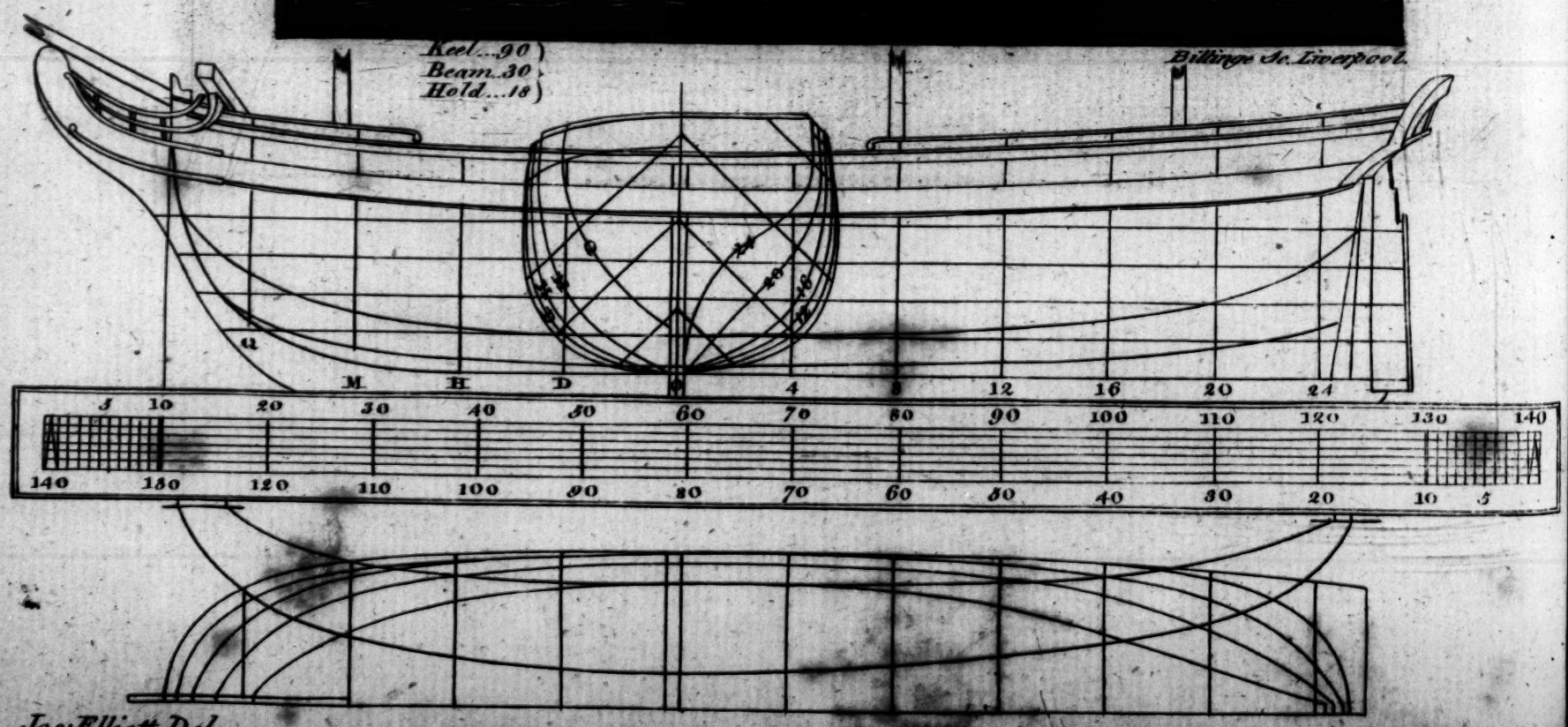


PLATE 1st.



Keel...90
Beam..30
Hold...18

Billinge Sc. Liverpool.



Jos: Elliott Del.

THE difference of theſe, being ſo great and various, made me very inquiſitive about the properties of a ſhip built at Liverpool for the Jamaica trade, with both ſtem and ſternpoſt ſtanding upright, perpendicular to the keel. The report I had from the commander of this ſhip was, that her ſailing came far ſhort of what was expected from the appearance of her bottom; and that before they altered, and raiſed her abaft, ſo as to ſtow more goods there, and ſo as to trim her to ſail two and a half feet by the ſtern, ſhe often refuſed either to ſtay, or ware equal to other ſhips in company; for whatever makes a ſhip gripe, or carry her helm too much to windward when ſailing upon a wind (as this upright ſtem did) muſt naturally be a hindrance to her ſailing, ſteering, ſtaying, or waring, by the rudder being ſo much more a ſtop-water to her head way; and as they were obliged to trim her ſo much by the ſtern, it hindered them the more in proportion to heave up their anchors from under her keel, or forefoot, which made it very dangerous to get her fairly underway in narrow waters, and increaſed her draught of water. Theſe important defects may all be imputed to the upright ſtem, which ought to be condemned in practice, and we ſhould endeavour to fix a rule to give it a proper rake, as will be mentioned hereafter, which among many other advantages, admits the anchors to heave eaſily up, clear of the forefoot, ſo that a ſhip may be got the readier under way, in narrow waters, which is of great importance to avoid dangers.

I HOPE there has been enough ſaid to condemn the practice of building ſhips with upright ſtems. Yet I approve and recommend to build them with upright ſternpoſts, for there cannot be a more certain proof of its being a wrong practice to build ſhips, and eſpecially full ſhips, with raking ſternpoſts, than the expenſive method commonly practiſed to mend the defects of the bad ſteering of ſuch. They are obliged to take off their rudder-bands, and add as much tapered poſt as can be well faſtened to the after part of the mainpoſt, to bring the after part as near upright as they can, which has been known to be of great ſervice on this occaſion and evidently points out that all ſhips ſhould be built with the after part of their ſternpoſt upright, perpendicular to the keel, which gives the utmoſt poſſible length and regularity to the ſhip's run, acts as a lee-board to help her ſailing to windward,

and

and gives the utmoſt poſſible power to the helm to ſteer and manage her to the greateſt advantage on important occaſions.

Obſervations on the Bows and Buttocks of Ships.

A Remarkably great difference may be obſerved in the curvature of the bows and buttocks of ſhips, and the effects of them at ſea, which I have experienced from the over-full bowed collier, (which the ſeamen uſed to ſay would drive a t---d before her bows a mile, before it could get clear of them,) to the over-ſharp bowed ſhip formed like a wedge, that would not bear to carry a reaſonable neceſſary preſſure of ſail upon a wind in a rough ſea, without plunging her ſharp bows and forecaſtle ſo dangerouſly deep into the ſea, as to fill her main deck, full and full, with water, which not only deadened her head way ſo as to hinder her ſailing, but ſtrained and filled her with water to ſuch a dangerous degree, as to oblige us to ſhorten neceſſary ſail, and add bailing to pumping, to ſave her from ſinking on ſuch occaſions.---The buttocks as well as the bows deſerve particular notice, for if they are built too full in proportion to the bows, at the load or ſailing mark, they will tow a great deal of eddied, or what is called, dead water after them, which not only hinders both ſailing and ſteering, but in bad weather, when the waves run high, they lift the ſtern and plunge the ſhip's head too much into the waves in proportion, when neceſſity obliges to carry a preſſing ſail, and make her to ſhip a great deal of water, which is both dangerous and injurious to ſailing, as has been obſerved; and if the main tranſom be too broad and lies too low, it increaſes the bad effects in proportion.

But all defects of this kind are beſt proved by facts, and from experience. In the war 1745, I was in a fine frigate-built ſhip for the Leghorn trade, that carried twenty ſix pounders on her main deck. and went a cruiſing in the Mediterranean, but ſhe having too full buttocks in the water, as above deſcribed, this, as I reckoned, hindered her ſailing to expectation, and having a very ſharp concave, entrance below, and a pretty full harping above, occaſioned her to have a very bad jerking, deſtructive, pitching motion, when obliged to carry any thing of a preſſing ſail in a rough

rough ſea, and always put our maſts in great danger of being pitched away.

YET the buttocks, as may be obſerved, are often built too ſharp at the load mark in proportion to the bows, which appears to me evident from the many ſhips that have been built what are called full bowed and clean tailed ſhips, which mode of conſtruction has had a great run in practice, and therefore deſerves particular notice.

FULL bows and clean tails, as they are called, I obſerve has been carried to the extreme in conſtructing ſhips for the coal trade, and in ſome capital merchant ſhips built lately, which method reaſon as well as experience ſhews not to be attended with the advantages expected from it, for their over full bows, eſpecially when loaden, as obſerved of the colliers, always drive a great ſwell of water before them, which, as they may be ſaid to be always ſailing up the hill againſt the ſwell of water, not only obſtructs their ſailing through the water, but hinders their ſteering even in fine weather and ſmooth water; and in bad weather, when the waves run high, puts it out of the power of the beſt helmſmen to ſteer them near their courſe, and when ſailing before the wind at ſuch times, they are very liable to broach too, and the oppoſing and lifting property of their broad bows, in proportion to their thin tails, (eſpecially if they have narrow tranſoms,) makes them very liable to be pooped; and in lying to, plunges their counters and ſterns dangerouſly deep into the ſea, and makes them ride very hard upon their cables at an anchor at ſuch times.

I experienced the ſame defects, from the ſame cauſe, though in a leſs degree, in a codſmack which I got built with full bows, a clean tail, and a narrow tranſom, according to a draft drawn by a famous ſhip-builder in London; which I got improved upon, by cauſing an ingenious builder at Liverpool to build another of the ſame dimenſions, but with ſomewhat ſharper bows, and more middling-full buttocks, ſuitable to each other, at the water's edge, and a broader tranſom, which had the deſigned effect, and gave her the advantages of being both a better ſailer, and a better ſtormy weather veſſel, than the other, which codſmacks require to be, for they are obliged to lie to, to catch their fiſh, and to beat the ſea in all weathers poſſible to get them alive to market.

THIS evident improvement upon the clean tailed veſſel, and the experience I had afterwards in a privateer built by the ſame man, 1756, for a common merchant ſhip, with what I call middling full

full bows and buttocks, anſwered the purpoſe ſo well in ſailing, that the ſucceſs attending it excited me to preſent him a piece of plate, with a ſuitable motto, "*as a grateful acknowledgment to Robert Brekel, &c.* whoſe name I think juſtly deſerves to be recorded for building good ſailing merchant ſhips. And other merchant ſhips built ſince by him and by other builders at Liverpool, with middling full bows and buttocks, have been remarkably ſucceſsful as cruiſers in the war 1778, in diſtreſſing our enemies and enriching ourſelves; and have, by fair ſailing in chaſe, taken ſeveral of the enemies ſharpeſt built veſſels, which have been conſtructed for ſailing only, with their bows and buttocks formed like wedges, which only anſwers the purpoſe of ſailing faſt in fine weather and ſmooth water, but not in rough winds and waves, when, as obſerved page 21, middling full bowed and buttocked ſhips will have the advantage of them.

THESE inſtances may be added to thoſe I mentioned in the former edition on the difference of ſtrong, middling-full built ſhips, and very light ſharp ſhips' ſailing. In the war 1746, I was in one of our Eaſt India ſhips, which was fitted out for a cruiſing ſhip, and was taken by a French ſquadron of ſharp Toulon built ſhips in little winds, but afterwards, when it came to blow ſo ſtrong as to put us under cloſe reefed topſails, our veſſel could be the headmoſt and weathermoſt ſhip of their fleet.

A LITTLE time after this I got the command of a very extraordinary ſharp, ſlight, ſhip, built at the Iſland of Malta, with very ſmall ſcantling of timber and plank, long, low, and narrow, being only 27 feet beam to 88 feet keel, with ſhelving ſhallow, ſharp main body, bows, and buttocks, for a cruiſing ſhip, which purpoſe ſhe anſwered extraordinary well in little winds, fine weather, and ſmooth water. In chaſing large, in little wind and a head ſwell, we have ſteered right up to the chaſe, when all their endeavours could not keep their ſhip's head to the ſwell, but lay broad ſide to it. A ſmall preſſure of wind and ſail would put this ſhell of a ſhip to her utmoſt ſpeed, ſo that we never deſired the wind to blow with a greater velocity than about ten miles an hour, when, I reckon, a middling ſtiff ſhip can juſt carry top gallant ſails upon a wind in ſmooth water, which weather gave us the greateſt advantages in ſailing, compared with other ſhips, in chaſe, to take or leave the enemy at pleaſure. But in tacking her, when it blowed ſo freſh that we could juſt carry whole topſails, we were obliged to haul up our courſes to make her ſure in ſtaying, other-

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ways ſhe would get ſuch ſtern way before ſhe brought the wind a-head, as prevented her ſtaying. This bad property I attributed to the lightneſs and length of her body in proportion to her breadth, that could not bear ſo much ſail a-back in the long time ſhe took to bring the wind a-head.

In cruiſing with this weak ſhip, it often happened that we fell in with our cruiſing ſtrong ſhips of war, who naturally gave chaſe to us, and we to them, till we knew them; when commonly we made ſail and ſteered from them, and left them with eaſe in light winds till we loſt ſight of them. But once it happened in a freſh gale, that we run before the wind in chaſe within about two miles right to windward of one of our ſeventy gun ſhips, which was in chaſe of us, when we hauled the wind, the ſea being ſmooth, thinking to out ſail them as uſual, but we could only carry cloſe reefed topſails, when they out carried us with ſail, and gained upon us to windward, and would have brought us to in ſpite of our utmoſt endeavours, if we had continued ſailing cloſe by the wind; but the weather gage we had, admitting us to ſail a point or two from the wind, that gave us the advantage of leaving them by ſailing large. And we met with one of our King's twenty gun frigates that was fully a match for us in ſailing large in a gale of wind. I mention theſe particular circumſtances relating to this ſhip, in order to invalidate that notion of a ſhip ſailing faſter by being made weaker; for this ſhip was ſo weak that, in bad weather, when the waves run high, we could hardly keep her together, and in chaſing to windward at ſuch times ſhe uſed to plunge her over-ſharp bows ſo deep into the waves, as to oblige us to ſhorten ſail, and add bailing to pumping to ſave her from ſinking, ſo that if the chaſe had known our condition, and kept their wind, they might have ſaved themſelves from being taken; but they bore away before the wind, which gave us the advantage to take them, and then we were obliged to run before the wind to a road-ſtead to ſtop our leaks, and to go to the Iſland of Malta, to get the veſſel repaired and ſtrengthened.

These facts, related from experience and obſervation, evidently prove, that there is a medium between theſe extremes of the great diverſity and oppoſite forms of the bows and buttocks of ſhips, which would anſwer beſt in all weathers in general, and which certainly ought to be aimed at by ſome fixed rule, to prevent as much as poſſible ſuch important defects as have been mentioned by their being too full or too ſharp, and to proportion them to each

other to the greateſt advantage for a ſhip's ſailing, not only in fine, but in rough and bad weather, on important occaſions, and to be lively and eaſy in the ſea when the waves run high in a ſtorm, when put paſt carrying ſail, but obliged to lie to, or come to an anchor and ride hard upon a lee ſhore, &c. having no head way, and when lying to as in common, with the helm a-lee, they get ſtern way, or when waring or ſcudding before the wind in a ſtorm, at which times all ſhips require to have what I call a middling broad tranſom, and a moderate ſpreading buttock at the load mark abaft, to buoy up and to prevent their being pooped, and the moſt weak and dangerous parts of a ſhip, the counter and ſtern, being liable to be ſtove in by the power of the waves ſtriking againſt them. And not only on this account of making ſhips ſafer and better bad weather veſſels, as laſt mentioned, but to make them ſail faſter in general, I cannot help thinking but that they require rather fuller buttocks than bows, in the water lines at their load marks, at the ſternpoſt than at the ſtem; for it ſhould be conſidered that it is the bows entrance, and fore body of the ſhip that have to divide and ſink the particles of water to make their paſſage through it, with the leaſt poſſible reſiſtance, and as the particles of water near its ſurface are eaſier divided than ſunk, the bows ſhould be formed ſharper than the buttocks, that the impulſe of the wind or waves may force the ſhip forward the eaſier in her progreſſive motion through the water, the reſiſtance of which ceaſes at the midſhip or main frame, where the water begins to riſe and cloſe upon the tapered after-body of the ſhip, with a tendency to help her forward in her progreſſive motion, and the buttocks ſpreading rather fuller than the bows at the water's edge, the water will act with more power by its preſſure upon the buttocks, if well formed, not only to ſteady and ſupport the ſhip abaft in a rough ſea, as has been obſerved, but to increaſe her progreſſive motion when ſailing faſt. And this is farther confirmed from experience in thoſe famous-ſailing, ſharp built veſſels, called cutters, by the neceſſity they find themſelves under to trim them four or five feet, or more, by the ſtern, even till they bring their ſquare tucks deep in the water abaft for their beſt ſailing trim.

So that our faſteſt ſailing veſſels may be ſaid to be juſt the reverſe of the full bowed and clean tailed ſhips, and to have clean or ſharp bows, and full tails or buttocks in their water lines, at their beſt ſailing trim, and ſquare tucks deep in the water, muſt certainly tow eddied water after veſſels and retard their ſailing much more

more than circular formed buttocks would do; which various and oppoſite extremes in forming the bows and buttocks, and thoſe other important defects ariſing from the bad principles of their conſtruction abovementioned, may no doubt, in a great meaſure be avoided, by fixing on ſome ſuch as the following natural rules, which I humbly offer to give hints for, endeavouring to point out how ſhips in general ought to be built to anſwer their deſigned purpoſes to the greateſt advantage, from what has occurred to me from reaſon, experience, obſervation, and converſation.

Hints towards fixing Rules, for the beſt Conſtruction of Ships' Bottoms.

I WOULD recommend, to prevent Ships' bottoms from hogging upward amidſhips, as has been mentioned, to have the fore and after part of the keels deep enough, that the upper part may be made to admit a rabbit for the garboard ſtreak, that the main body and bearing part of ſhips' bottoms may be made to form an arch downwards in their length, ſuppoſe with the ſame ſheer as their bends, at the rate of about two inches for every thirty feet ofthe extreme length of the keel towards the midſhip or main-frame, which may be reckoned the crown of the arch; and the lower part of the keel to be made ſtraight, but laid upon blocks ſo that it may form a regular convex curve downwards at the rate of an inch for every thirty feet of the extreme length of the keel, the loweſt part exactly under the main-frame; which curve, I reckon, is only a ſufficient allowance for the keel to become ſtraight below, after they are launched afloat, by the preſſure of the water upward againſt their floors amidſhips, as mentioned page 12, which cauſes their tendency to hog. And certainly a ſtraight keel is a great advantage in ſailing, as well as to ſupport them when laid upon level ground, or on ſtraight blocks in a repairing dock, without taking damage, as obſerved page 17, 18, and 19.

2d. As ſquare ſterned ſhips, from experience, are formed to anſwer all trades and purpoſes better than round or pink ſterned ſhips, I would recommend the fore part of the ſternpoſt, on account of drawing the water-lines in the draft, only to have a few inches rake, that the after part may ſtand quite upright and perpendi-

cular to the keel, for reaſons given page 21: and for the rake of the ſtem I would purpoſe the rabbit for the hudding ends for the entrance and bows from the keel upwards, to form the ſame curve as the water-line from the ſtem at the harping towards the main breadth, and the bows at the harping to be formed by a ſweep of a circle of half the three fourths of the main breadth; and the main tranſom to be three fourths of the main breadth; and the buttocks, at the load or ſailing mark aft, to be formed, the ſame as the bows at the harping, with a ſweep of a circle of half the three fourths of the main breadth, to extend juſt as far from the ſtem and ſternpoſt as to admit a regular convex curve to the main frame, and thence down to the keel to form regular convex water-lines, without any of thoſe unnatural hollow, concave, ones, either in the entrance or run: which rules in my opinion will agree with the main body of the ſhip, whether ſhe is deſigned to be built full for burden, or ſharp below for ſailing; as repreſented by a Frigate's hull, plate 1. which I got drawn by my friend Thomas Mitchel, Eſq. a navy ſurveyor, to anſwer the purpoſe of a cruiſing, or trading ſhip, and had a building draft drawn to it by my late ingenious friend, Captain Joſeph Taylor, who had talents and a turn of mind for ſuch noble purpoſes as this was deſigned. The ſhip was intended to be built by ſubſcription, to cruiſe againſt our enemies, and the draft was well approved of by our moſt ingenious draftſman and builder, Robert Brekel, before mentioned.

3d. This rule for raking the ſtem will admit all the water lines in the ſhip's entrance to form convex curves all the way from the ſtem to the midſhip or main frame, which anſwers much better for ſailing, as well as making a ſhip more eaſy and lively in bad weather, than thoſe unnatural, concave, hollow entrances, which occaſion ſuch deſtructive pitching motions, as mentioned page 22. And the bows ſhould flange off, rounding in a circular form from the bends up to the gunwale, in order to meet the main breadth the ſooner, with a ſweep of half the main breadth at the gunwale amidſhips, which will not only prevent them greatly from being plunged under water in bad weather, but ſpread the ſtanding fore rigging the more, to ſupport theſe material maſts and ſails forward to much greater advantage than in thoſe over ſharp bowed ſhips, as has been mentioned. And as the ſailing trim of ſhips in general is more or leſs by the ſtern, this makes the water-lines of the entrance in proportion the ſharper, to divide the particles of water the eaſier,

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ſo that the ſhip may preſs through it with the leaſt reſiſtance, as more particularly mentioned in page 26.

4th. The run ought to be formed ſhorter or longer, fuller or ſharper, in proportion to the entrance and main body, as the ſhip is deſigned, for burden or ſailing faſt. The convex curves of the water-lines ſhould leſſen gradually from the load or ſailing mark aft, as has been mentioned, downwards, till a fair ſtraight taper is formed from the after part of the floor, to the ſtern-poſt below, without any concavity in the water-lines, which will not only add buoyancy and burden to the after body and run of the ſhip, but, in my opinion, will help both her ſailing and ſteering motions; for the preſſure of water as it cloſes and riſes upon it to come to its level again, and fill up that hollow which is made by the fore and main body being preſſed forward with ſail, will impinge, and act with more power to help the ſhip forward in her progreſſive motion, than upon thoſe unnatural concave runs, which have ſo much mere flat dead wood, that muſt, in proportion, be a hindrance to the ſtern being turned ſo eaſily by the power of the helm to ſteer the ſhip to the greateſt advantage. And ſince writing my Second Edition, where finding fault with too ſharp buttocks, I have obſerved ſeveral ſhips fill them up, to avoid the great danger they have found, being liable to, from experience of being pooped, by which one of our ſhips called the Backhouſe, James Collinſon, Maſter, and crew received very great damage, and had a very narrow eſcape from foundering, which was publiſhed in our newspapers.

Some ſuch plain ſimple rules as theſe, which nature, reaſon, and experience evidently point out to us, ought to have a fair trial in drafting and conſtructing ſhips, and to have their good or bad properties juſtly obſerved and compared with other ſhips of different conſtruction, when they are as near as poſſible under the ſame circumſtances in practice, by which means ſtandard rules may be fixed for the beſt and only conſtruction for ſhips, as there can be but one form that will anſwer beſt; otherwiſe we might ſuppoſe they would all anſwer equally well.

But it muſt be allowed, that building ſhips upon this principle, with their bottoms curved in their length downwards, only prevents their hogging and ſtraining upwards, but does not prevent their ſagging and ſtraining downwards, which all ſhips are liable to do to dangerous and fatal degrees, when very heavy ballaſt, cargoes, or materials are improperly ſtowed by the common method,

thod, too much in the main body of the ſhip, ſo as frequently to occaſion great damage, and fatal loſs of property and lives, as particularly mentioned, page 16; which certainly deſerves our utmoſt endeavours to prevent as much as poſſible. For this purpoſe I ſhall venture to propoſe a different method of ſtowing theſe heavy materials, regulated by the help of what I call a ſhip's Form-Gage, which may eaſily be fixed in the manner hereafter deſcribed, for a guide, to prevent ſhips' bottoms from being hogged, upwards, or ſagged downwards, by improper ſtowage, and to keep their bottoms nearly in the ſame form in which they were built, and thus to make them leſs liable to labour and ſtrain to ſuch dangerous and fatal degrees in high waves at ſea, as before obſerved.

On proportional Dimenſions for Ships.

AS the comparative good or bad properties of ſhips for ſailing, ſteering, ſtaying, or waring, as well as their being lively and eaſy at ſea, and proceeding with ſafety, free from the great danger of their being too crank and liable to overſet, or being too ſtiff and labourſome, as it is called, (which makes them roll ſo deep into the ſea, and with ſo quick motions as to roll away their maſts, not only in bad weather, when the waves run very high, but in fine moderate weather, when there often run long ſwells of waves,) as theſe, I ſay, depend on the proportional dimenſions of their length, breadth, and depth, being properly or improperly adapted to each other, the ſubject muſt be allowed to be of ſuch importance as to deſerve particular notice, and our utmoſt endeavours to fix upon ſome rule for a medium that may come neareſt the beſt dimenſions for the different trades, or purpoſes, they may be deſigned for.

On ſhips too long.

As a ſeaman I venture to give my remarks on the ſubject, having obſerved, when ſailing, that veſſels and ſhips which are firſt built, or lengthened, too long in proportion to the breadth, are bad to ſteer, ſtay, or ware on neceſſary occaſions. And when built too high, in proportion to their breadth, it makes them ſo crank as to be in danger of overſetting, as proved to be the caſe with one in conſort with me, and was fatal both to ſhip and crew. I judge this therefore the more dangerous of the two extremes; and as theſe veſſels require to be ſet ſo much down in the water by

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an extraordinary weight of ballaſt, goods, or heavy materials before they are ſufficiently ſtiff to carry ſail, this is a great hindrance to their ſailing in general, but eſpecially upon a wind, as it is known from experience that many a fine bottom has been ſpoiled for faſt ſailing, by having too great a top built upon it, which, as I have been told by ſhip-builders, is owing to that unfair and erroneous method of calculating their tonnage for meaſurement by half the breadth for the depth, for payment, inſtead of the whole depth they are built; which latter practice ought in juſtice to take place between the builders and owners, to be a check upon owners who want unproportional height, in order to gain more ſtowage and accommodation for people and paſſengers, &c. by which their ſhips are made defective in thoſe important points abovementioned.

On ſhips too crank, owing to their being built too high.

I have heard that a maſter of a crank ſhip, uſed to ſay when it blew freſh, ſailing by the wind, her trim was to ſail with the lee windlaſs end in the water, which muſt be allowed to be a bad property. And I have known many inſtances where owners of ſhips have been at great expence, to reduce their ſhips that have been built too high, to more proper proportional dimentions according to their breadth.

We had a late fatal loſs of a large new frigate on her firſt voyage, which had overſet with upwards of five hundred ſlaves, and her crew all drowned except two ſeamen and three ſlaves; which added to the many other ſuch inſtances, proves the neceſſity to endeavour to get ſuch general rules fixed to prevent as much as poſſible ſuch dreadful loſſes; for this ſhip, when launched overſet and ſunk for want of more beam and a fuller bottom to ſupport her over high proportional built top; for we ſhould always aim to make ſhips juſt ſtiff enough to carry away their maſts before they overſet, which makes the moſt compleat ſtructure and trim they can be brought to; which I have been long endeavouring to do.

On Ships being too ſtiff and labourſome at Sea.

I SPEAK from experience in one of our Government old 20 gun ſhips called the Leoſtoff, which we bought, and fitted out with lighter guns and materials than ſhe formerly carried, and loaded her with a general cargo of different ſorts of goods for the Weſt

Weſt Indies, yet ſhe was but fourteen days at ſea when down came our main yard upon deck, occaſioned by the new main-tye being chafed to pieces in the middle or inſide of the rope, by the ſtrands rubbing againſt each other from the ſhip's extraordinary deep and quick rolling motions, which ſoon wore out the other new rigging, and worked looſe her hull in proportion.

In a paſſage from Jamaica, with quite a full ſhip, we have rolled away a new ſet of main laniards in one night. In a paſſage to Leghorn, loaden with lead, leather, &c. we ſtowed the lead upon a great height of leather, which was ſcrewed down with boards upon it, in order to keep the ſhip tolerably eaſy at ſea, and to prevent the damage that might be done by her bad rolling property. This anſwered the deſigned purpoſe very well the firſt part of the paſſage, till, by her labouring, the weight of the lead preſſed the leather lower; and hence the latter part of the paſſage ſhe became ſo labourſome as to roll away two topmaſts, in ſpite of our utmoſt endeavours to ſave them. When loaded with a cargo of wheat from the Gulf of Venice, to Cadiz, we ſtowed it cloſe up to the main deck in the main body of the ſhip, to prevent her rolling, yet ſailing before the wind in fine weather, carrying ſtudding ſails and topgallant ſails in company with other ſhips, when only a long ſwell of a following ſea has come on, it obliged us to take in our ſtudding ſails and topgallant ſails, and to lower our topſails half maſt, to prevent the topmaſt being rolled away, when the other ſhips carried all their ſmall ſails without any danger of their maſts, from rolling.

These facts make it evident that this ſhip's decks lay too low in proportion to her breadth, for a merchant ſhip, to ſtow and carry cargoes in general to profitable advantage, and was only fit for her firſt deſign, to carry and ſupport heavy guns, maſts, yards and materials, which would naturally keep her more eaſy at ſea, and prevent rolling to ſuch deſtructive degrees; not only the maſts, ſails and rigging, &c. (as hath been mentioned) but the hull is worked looſe and made leaky by it, and when it happens that ſuch veſſels loſe their maſts and heave their guns overboard, when the waves run high, it occaſions their rolling the more in proportion, for want of their maſts and guns to counterpoiſe and keep them more eaſy in the ſea, ſo as to endanger and often to occaſion their foundering. Such fatal conſequences made me think that this ſhip's decks were laid too low in proportion to her breadth, even for a ſhip of war, which I reckon would be ſufficiently ſtiff if ſhe would

would bear to carry away her maſts before ſhe is preſſed down on her broad ſide ſo as to overſet her, which is the medium that ſhould be aimed at between this and an over crank ſhip, in which when preſſed down on her ſide by the wind or waves, inſtead of the danger of carrying or rolling away her maſts as abovementioned, her rolling motions are comparatively ſo ſlow and eaſy in coming upright again, that the greateſt danger is apprehended from her not riſing, but overſetting.

But theſe very ſtiff labourſome ſhips muſt be allowed to have an advantage of bearing to carry a more preſſing ſail upon a wind with an upright ſide, in compariſon with the crank ſhip that goes heeling much along upon her ſide at the ſame time. And they will ſhift themſelves, without ballaſt, as was the caſe with the abovementioned ſhip; for we have lain ſafely in an open road-ſtead, with our topmaſts up and our guns upon deck, with a clean ſwept hold, ready for her cargo.

Hints towards fixing Rules for the beſt proportional Dimenſions of Merchant's Ships in general, for Length, Breadth, and Depth.

HAVING given reaſons and hints towards fixing rules to form the bottoms, bows, and buttocks of merchant s ſhips, I venture, for the reaſons laſt aſſigned, to give hints to fix rules in general for the beſt dimenſions as to their breadth and depth in proportion to their length.

Having recommended, for reaſons given, the after part of the ſternpoſt to be upright, which adds ſome length to the keel above common, I recommend the main or midſhip frame to be a third of the length of the keel, and to be laid ſeven twelfths of the length of the keel from the after part of the ſternpoſt, and the depth of the hollow from the main or gun deck to the ceiling at the mid-ſhip or main frame, to be ſix tenths of the main breadth. For inſtance, ſuppoſe a ſhip is to be 90 feet keel, this gives 30 feet beam; the tenth part of that is 3 feet, and ſix times 3, gives 18 feet for the depth of the hold or hollow, from the main or gun deck amidſhips, to the ceiling, and the lower beams or lower deck may be laid higher or lower as may beſt anſwer ſtrength, ſtowage, or other advantages for the trade or other purpoſe the ſhip may be deſigned for. The ſame rule naturally points out that the length

of the keel ſhould be three times the breadth of the beam, by which the ſtowage, burden, and value of the ſhip is to be calculated. And it may not be amiſs, if, in addition to theſe proportional dimenſions, the hints which have been given at large for rules to form the bottoms, entrance, runs, bows and buttocks of ſhips, be here briefly repeated, in order that the propoſed form of the whole ſhip may be the better underſtood.

I HERE begin with the laſt propoſed general rule for the proportional dimenſions, recommending the after part of the ſtern-poſt to be upright, and the length of the keel to be three times the breadth of the beam, and the depth of the hold or hollow to be ſix tenths of the main breadth at the midſhip or main frame, which I would have to lie ſeven twelfths of the keel from the after part of the ſtern-poſt, where I would propoſe the middle and loweſt part of the floor and main body of the ſhip to form an elliptical arch, or curve, in her length downwards, as recommended page 18.

FOR example, ſuppoſe the laſt mentioned deſigned ſhip of 90 feet keel and thirty feet beam, the main frame is to lie between the two loweſt dead flat floorings 7 twelfths, that is, 52 and a half feet from the after part of the ſtern-poſt, there to be ſix tenths of the breadth of the beam, that is, 18 feet deep in the hold, or hollow from the main or gun deck to the ceiling, and the hold beams, or lower deck, to be laid higher or lower as the ſtowage and trade may require. And to curve the bottom to form an arch in its length downwards as has been ſo ſtrongly recommended for the important reaſons given, I would propoſe the upper part of the keel with the groove for the garboard ſtreak to be made to form a convex curve of ſix inches under the midſhip or main frame, and the lower part of the keel to be ſtraight, but laid upon blocks forming a concave curve of three inches, or of one inch for every thirty feet in the extreme length of the keel, under the midſhip or mainframe, which, for the reaſons given, page 12, I reckon in this length of keel will ſoon become ſtraight enough to ſit eaſy and ſupport the ſhip on ſtraight blocks or level ground, as occaſion may require.

To form the entrance and run of this ſhip by the rules laid down, page 28; $22\frac{1}{2}$ feet is her breadth at the main tranſom, three fourths of her main breadth, and the water line of the bow at the harping or upper part of the bends, as well as the buttock at the load mark aft, is to be formed by a ſweep of eleven feet three inches, half the length of the main tranſom, juſt as far from the ſtem and ſtern-poſt as to admit to form a regular convex water-

line

line curve to the midſhip or main frame. And the rake of the ſtem is to admit the rabbit for the hudding ends of the bow and entrance to form the ſame curve from the keel upwards, as the water-line from the ſtem at the harping towards the main breadth. And from the huddings at the ſtem of the entrance, as well as at the ſtern-poſt in the run, all the water-lines ſhould form regular convex curves to the main frame and loweſt floorings, which are either long and flat for burden, or riſing and ſharp for faſt ſailing; which laſt muſt give the advantage, and is abſolutely neceſſary for the ſlave trade, to ſhorten the paſſage by ſailing faſt when dangerouſly crowded with ſlaves. And the bows from the harping ſhould flange up to the gunwale to form the bows with a ſweep of a circle of half the main breadth at the gunwale amidſhips, as mentioned for the reaſons given, page 29.

THESE are the hints that have ſuggeſted themſelves to me from experience and obſervation, towards fixing ſome general rules for a ſtandard, by which to conſtruct merchant's ſhips upon certain principles in general, free from thoſe important defects that have cauſed, and may ſtill occaſion, ſuch dangers, damages and loſs, as have been mentioned, and to give them all poſſible good properties to anſwer the trade they are deſigned for, to proceed with the greateſt probability of ſafety and ſucceſs, and to be lively, dry, wholeſome ſhips at ſea in bad weather.

YET before concluding this important ſubject, it may be neceſſary to endeavour to anſwer objections that ſome may make to the buttocks formed by a ſweep of a circle of half the three fourths of the main breadth at the load mark aft, being too full for a faſt ſailing ſhip.

BUT I would have them to conſider, how ſuch projectile, round, circular bodies, as cannon balls, bombſhells, &c. forced into the moſt violent and ſwift motion poſſible through the air, though 800 times lighter than water, admit it to cloſe round behind them, without making a Vacuum, which would inſtantly ſtop the great intended range they are thrown to. Upon the very ſame principle I have very often, for a long time together, obſerved, (by looking out of the cabin windows of a ſhip of nearly this conſtruction and trim,) how the circular formed buttocks will admit the particles of water to riſe and cloſe round them to the rudder, and to waſh or drive off the other particles, ſo as not to leave any eddied water to be towed after the ſhip to retard her ſailing, or ſteering motions. And that according to the ſtrength

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of the wind, and as the ſhip is preſſed with ſail to increaſe her head way, ſo much in proportion the bows are preſſed down, and the buttocks liſted up, which forms a ſharper run for the water to cloſe in upon them more eaſily when the ſhip ſails faſteſt If a ſhip be under the neceſſity of carrying a preſſing ſail againſt high wind, and waves in a ſtorm, near a lee ſhore, or lying to, or ſcudding before the wind for ſafety, at ſuch times theſe circular formed buttocks and a fair drawn run (ſuch as have been recommended,) in my opinion will have greatly the advantage of thoſe ſhips built with very ſharp runs, and thoſe unnatural concave hollow water-lines which afford little or no bearing body to ſupport a ſhip aft, to prevent the ſtern from being plunged dangerouſly deep into the waves, which cauſes them to ſtrike with ſuch amazing and alarming power againſt that moſt weak, dangerous, projecting, part about a ſhip, the counter, againſt which I have felt ſuch violent ſhocks as if it would be ſtove in, or part the ſtern from the bottom, when the rails of our balcony or ſtern-gallery have been waſhed away. For the truth of this defect in ſuch ſhips I appeal to thoſe birthed in their great cabin or gun-room. Theſe I hope will be thought ſufficient reaſons for thinking that ſuch circular bows and buttocks as have been recommended, will prove the beſt medium between the two extremes, of being two ſharp, or too full. Of late, I think our builders of merchant's ſhips, to imitate our King's frigates, have gone much into the extreme, by putting ſo much dead wood in the run of our merchant's ſhips near as high as the load mark aft, not conſidering that the King's frigates are built uniformly ſharp for ſailing, and have only proviſions and materials to carry, but marchantmen have, not only proviſions and materials, but full cargoes, to carry to make profit by their voyages. And it is well known that dead wood in the run adds no buoyant property to a ſhip, not even to ſupport itſelf; for Oak timber, after being ſometime ſoaked in water, will not ſwim, but ſink in it, and uſing it ſo high, forms thoſe unnatural hollow concave water-lines as have been mentioned. So much dead wood, it may be juſtly ſaid, only increaſes the burden of payment for meaſurement, but not the tonnage for carrying, nor gives neceſſary ſupport to a ſhip's ſtern and quarters, either a float or lying aground, in compariſon with the form of a ſhip's bottom as mentioned page 19; the run to be formed with a regular fair taper from the main frame to the lower part of the ſternpoſt, the ends of the floorings and futtocks with a regular curve pointing from the keel up, to the load mark, may be ſaid to act in a great meaſure as ſpur

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ſhores to ſupport the ſhip either a float or aground, as the frigates and all ſhips of war are obliged to have them, not only in launching but afterwards, where they ſew by the tide upon the ground, as at Deptford, till they got to lie afloat. And I have obſerved almoſt new, full, and ſtrong veſſels ſtrain ſo much as to make a great deal of water, and oblige them to go into our Graving-Docks to be caulked anew; owing in my opinion to the inſufficiency of their runs, being formed moſtly of dead wood, to ſupport their ſtern and quarters, though deſignedly laid upon hard level ground, where they expected to lie without taking damage.

On Ships with both Bows and Buttocks too full for ſailing faſt.

BY way of compariſon, I refer to thoſe very full, flat floored, Dutch-built ſhips as they are commonly called, which are formed near to a long ſquare, with two high ends, and very full bows and buttocks. This form muſt be allowed to give them the advantage of ſtowing and carrying a great deal of goods, and rendering them comparatively very dry, lively, ſafe veſſels in bad weather at ſea, which makes them venture to load them ſo deep as to leave very little free-board amidſhips; but then at the ſame time it muſt be allowed that they are very ſlow in their ſailing and ſteering motions, ſo much ſo, that I have been ſurpriſed at the patience of their commanders, who ſeemed unconcerned, when we have been ſailing ſo very faſt cloſe by them, that our ſeamen, apt ſometimes to be unmannerly, have inſultingly called to them to let go their anchor to prevent their going ſo faſt aſtern.

I HAVE given reaſons why an overfull bowed ſhip is retarded in her ſailing motion by driving too great a ſwell of water before her bows. And in my opinion one great reaſon why an overfull buttocked ſhip is retarded both in ſailing and ſteering motions, is becauſe ſhe tows too much eddied, or dead water, after her. For the particles of water certainly have both attractive and coheſive properties, as may be known by obſerving what a large drop of water will hang perpendicularly at a man's finger end, which proves theſe particles require force to part them, therefore they muſt hinder both the ſailing and ſteering motion by cohering to the ſhip's buttocks and to each other, which prevents the proper effects of the water upon the rudder.

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We had an inſtance of one of the firſt large ſhips that we had built at Archangel in my time, for the timber trade, that was of this conſtruction of both bows and buttocks being over full, which, with a fine fair wind and weather, with ſtuddingſails and all ſails ſet, could not be ſteered into Liverpool, but ran on ſhore againſt all the power of the helm to ſteer her, and was loſt. For theſe over full ſhips, for the reaſons above given, loſe both their headway and ſteerage to command them. And eſpecially when they come into ſhoal water, as to ſwell the ground as ſeamen call it,

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On a Ship built by the foregoing Rules, as I recommended.

HERE I conclude this important ſubject, with noticing the reſult and ſucceſs of my endeavours towards fixing general rules for the form, and proportional dimenſions, of merchant's ſhips in general, by giving a detail of a ſhip that was built for a Nephew of mine, Mr. William Ward, to whom I gave the manuſcript which I had wrote upon the ſubject: he ſhewed it to his Owners, who approved ſo much of the remarks, hints, and propoſed rules, as to ſay they wondered that I had not publiſhed them before, and they gave them to an ingenious Drafter of ſhips, Mr. Joſeph Elliot, who ſerved his time at the King's Yard at Deptford. He approved of them likewiſe, and drew the draft according to them, being the Draftſman of Mr. John Fiſher, who built this ſhip in Liverpool, called the Hall, of 362 tons, carpenter's meaſurement, for the Jamaica trade.

I reckon it owing to her curved main body in her length downwards, and bearing fair drawn run aft, as has been mentioned, that this ſhip was ſo buoyant as, when launched, to draw but 7 feet water forward, and 8 feet aft; and only 1 foot by the ſtern; and when maſted and full rigged, with anchors at the bows, &c. to draw but 8 feet 6 inches forward, and 9 feet 3 inches aft; only 9 inches by the ſtern, with a clean hold. And when full loaded with a Jamaica cargo which was diſcharged in good order, ſhe drew but 16 feet aft, and 14 feet 9 inches forward; 15 inches by the ſtern. And all ſhips ſhould be built, that when launched to ſwim no more than from 12 to 18 inches by the ſtern, nearly the ſame trim as when fit for ſea.

In regard to merchant's ſhips being of a proper ſtiffneſs, which I look upon as the moſt important good property that can attend them,

them, when built to ſhift themſelves without ballaſt, and to carry a cargo that is near of an equal weight, that juſt fills them full when loaded to their load marks, and to be ſufficiently ſtiff to bear a preſſing ſail by the wind upon neceſſary occaſions, and without being comparatively too labourſome at ſea, I reckon then they are as perfect in this property as can be expected; therefore this ought to be always aimed at.

On ſhips being of a proper ſtiffneſs.

THIS ſhip, though frigate built, with a waiſt 4 and a half feet deep, and a long quarter-deck and forecaſtle, went into the Graving-Dock to be ſheathed with copper, when full rigged, with top gallant yards up, and a clean hold without any ballaſt: they then feared ſhe would be two ſtiff and labourſome, which made me very inquiſitive about it. But from the report of her properties, which I think is from undoubted authority, ſhe proves only ſufficiently ſtiff, and comparatively an eaſy ſhip in the ſea. And I am further aſſured that ſhe ſtows, carries, and ſails, ſteers, ſtays, and wares uncommonly well for ſuch a full built ſhip; for her long main floorings are ſo flat as to have only 9 inches riſe at her quarter breadth from the middle line, ſo that to prevent damage to the cargo by ſuch flat floorings, they thought it neceſſary and fixed two lead bilge pumps, but the ſhip kept ſo tight in the voyage that they had no opportunity to try and make a report of their uſefulneſs.

ON inquiring of her particular trim for ſailing, her commander, who I always found a candid man, ſaid that he could preceive no difference in her ſailing, ſteering, or waring when a foot more or leſs by the ſtern; for in going from Kingſton, where he diſcharged moſt part of his outward bound cargo, to the North ſide of the Iſland, ſhe was more than two feet by the ſtern; and during the whole voyage ſhe ſtill retained her good properties of ſailing, ſteering, ſtaying and waring comparatively well in company with faſt ſailing ſhips outward bound. And in their paſſage home, they came up, and joined company, with a Liverpool ſhip built for the Jamaica trade during laſt war, deſigned for a faſt ſailing ſhip to take or leave our enemies; they kept company ten days, and found the HALL had the advantage in ſailing both by the wind and large. They then parted in a friendly manner, and ſhe got home four days before the other. Theſe advantageous properties here related, I attribute to thoſe natural reaſons given page 18, and particularly that of the greateſt preſſure of the water acting upwards with its greateſt power againſt the loweſt curved part of her bottom

tom under the midſhip frame, which muſt in a great meaſure act to preveut its ſagging downward, as well as a pivot, which makes her turn ſo eaſy, and be ſo ready to ſteer, ſtay, or ware, though the lower part of the rudder goes no lower than within ſix inches of the lower part of the keel, which was left to project abaft the ſternpoſt under the fore part of the rudder, to prevent it from being unſhipped by ſtriking upon the ground, and ropes for getting into the heel, as I have endeavoured to get repreſented in the hull of the ſhip, plate the 1ſt, figure 1, in which Mr. Elliot, abovementioned, has added ſketches of water-lines, and ſome frame timbers, to a ſmall draft that I had got drawn before, intended the better to explain my ideas, for the beſt form and proportional dimenſions of merchant's ſhips; a ſubject which I have been purſuing many years.

THE flanging circular bold form of this ſhip HALL'S bows, gives her the appearance of being, and by report ſhe is, a lively dry ſhip, forward, at ſea, but as the ſwell of the waves are kept off forward, they cloſe in again about her gang-ways, where ſhe ſhips the moſt water and ſpray of the ſea*.

THE tendency of this ſhip to hog I think deſerves particular notice. I ſaw by the Draft that the buoyant and bearing part of

* As this ſhip, HALL, anſwers her deſigned purpoſe ſo well as to give ſatisfaction both to the owners and crew, it may be well to repeat my propoſed rules in figures, that they may be the eaſier and readier underſtood by inſpection.

	Feet.	Inches.
Extreme length, or tread, of the keel from the forefoot to the heel at the after part of the ſternpoſt that ſtands upright, - - - - - - - - - - - -	90.	0.
The upper part to be hollowed out with a curve for the garboard ſtreak, 2 inches for every 30 feet in length to the main frame, to curve the ſhip's bottom in length downwards at the main frame, - - - - - - - - - - - -	0.	6.
The bottom of the keel to be made ſtraight, but put upon blocks laid with a concave curve, an inch for every 30 feet, to make it lie with a convex curve exactly under the main frame for an allowance for the tendancy of all ſhips to hog, -	0.	3.
Extreme breadth, at the main frame, one third of the length of keel, - -	30.	0.
Depth of the hollow at Ditto from the ceiling to the main deck, 6 tenths of the extreme breadth, -	18.	0.
The main frame to be between the two lower midſhip floor-timbers, 7 twelfths from the after part of the ſternpoſt, - - - - - - - - - - - - - - - -	52.	6.
The main tranſom to be 3 fourths of the main breadth, - - - - - - - -	22.	6.
Height of main tranſom from the upper part of the keel at the main frame to the upper part of the main deck, - - - - - - - - - - - - - - - - -	19.	0.
Rake of the ſtem to be formed ſo as to admit the hudding ends of the entrance and bows to form the ſame curve as the water-line from the ſtem at the harping towards the main frame. And this water-line at the harping at the upper part of the bends or the bows, as well as for the buttocks aft, at the load mark, to be formed from the ſweep of a circle of half the 3 fourths of the main breadth towards the main frame from the ſtem and ſternpoſt, which ſweep is from -	11.	3.
And the bows to flange out with the rake of the ſtem, till they are formed by the ſweep of a circle of half the main breadth, at the gun-wale amidſhips at the main frame, for the reaſons given.		

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her main body had the ſame convex curve downwards as the ſheer of her bends; but before launching I deſired my Nephew to try, with a tight line, how much the bottom of her keel curved downwards under the midſhip frame, which he did, and found it but 7 eighths of an inch, inſtead of 3 inches for her 90 feet keel, according to my propoſed rule of an inch to every 30 feet in length of the tread of the keel; and to try with the line from a knuckle timber by the ſtem to the taffarel rail, and make a mark upon the Pole fixed at the fore part of the main hatch-way, to obſerve, after being launched afloat, if he could perceive the height and weight of the head and ſtern, having then no bearing in the water to ſupport them, to drop any thing; but he could perceive none; yet when put upon ſtraight blocks in the Graving-Dock to be ſheathed with copper to her light water marks, and with wood ſheathing to her load marks, ſhe appeared to me to bear harder upon the fore and after blocks than on thoſe amidſhips.

But it was juſtly obſerved that theſe trials ſhould be made by ſight, and not with lines, for they always ſag downwards. I therefore got Mr. Elliot, the Drafts-man (before her going into the Graving-Dock after a ſeven months voyage to Jamaica, which muſt fix the form in which her bottom ſwam when afloat) to obſerve from the ſame knuckle timber forward to the taffaral rail aft, whilſt a carpenter's rule put againſt the ſide of the mainmaſt was ſeen exactly in that line, and a mark made there, when afloat, with a clean hold; and the trial was again made in the ſame manner, after ſhe came adry upon ſtraight blocks in the Graving-Dock, and this mark upon the mainmaſt was found an inch and half above the other, by the head and ſtern being raiſed ſo much by the ſtraight blocks, which makes it evident that her forefoot and heel muſt ſwim above an inch below the lower part of the keel under her main frame; which important defect muſt be allowed to increaſe, and the bad conſequence attending it, in proportion to the hogging of the keel and main body of all ſhips, as have been ſo very often mentioned. A certain proof confirming that this veſſel hogged, is, that when ſhe came upon ſtraight blocks in the Graving-Dock, her copper ſheathing was viſibly wrinkled at her forefoot and heel, and her mainmaſt then ſunk an inch and half. Therefore to remedy further this defect of hogging, and that of ſhipping water in the open waiſt which is common to all open-decked frigates, deſerves further notice and attention. All large, open, *deep waſted* frigates may be juſtly ſaid not only to be weak

Open deep waiſted veſſ.

Sels hog, & ſhip much water.

in that part, which tends greatly to make them hog, but alſo to be dangerous to a great degree when deeply loaded. On a voyage in 1738 to Madras and China, when our Eaſt India ſhips had open waiſts, not having water to go over the Flatts in turning to windward down the Swin, the common track for our deep loaded colliers, our veſſel ſhipped and leaked ſo much water, that it took all the pumps to keep her free, ſo that when we got into the Downs, the crew proteſted againſt going the voyage without her being lightened, but, a 50 gun ſhip of war being near, a ſignal was made, and they came and took the principal ringleaders out, and we proceeded on the voyage.

I WOULD recommend therefore, in all large frigates, to allow breadth enough to build them with a fluſh-deck, what they now call three deckers, which has many great advantages attending it.

A Fluſh Deck attended with many advantages

1. This affords great and good accommodations for the crew, and makes it ſo eaſy for them to run quite fore and aft upon it, that they can work and manage the ſhip much eaſier and readier by it. 2. When deep loaded, it prevents thoſe heavy waves of water being lodged upon deck, where the quick work is commonly leaky, as above mentioned, and thus may ſave a ſhip from foundering. 3. It fills up that weak and low part of the waiſt amidſhips, as may be obſerved in the frigates waiſt, plate I. figure 1, and the fluſh-deck going over it, ſtrengthens the whole frame of the ſhip, ſo that, like a ſtring to a bow, it helps greatly to prevent the ſhip's hogging; and to do this more effectually I would recommend the preſent practice of building our Eaſt Indiamen in London, which I reckon are the beſt and compleateſt merchant's ſhips in the world. They put a good chock lengthways upon the upper part of the keel between every floor timber within an inch of their height, and clip all the floor timbers, with the kelſon as they term it. And with the curve downward as recommended will certainly add great ſtrength to a ſhips bottom.

THIS bad property of the Ship HALL ſhipping water at her gangways, was cured by laying a ſpar deck upon her, though left room to ſtow a large long boat on the main deck, which made her anſwer ſo well for that trade, that the ſame Ownery, built another ſhip upon the ſame principles with a fluſh-deck fore and aft, with a pretty long quarter deck above; for the cabin and ſteerage in a plain manner for the ſame trade, but without the ornaments of carved works for a figure head and quarter galleries, &c.

&c. but only a knee head for the ſupport of the bowſprit, and called her the ELIZABETH.

I think it neceſſary to remark here, that in building this ſhip, that my rule to form the bottom and keel with a covex curve downward in her length was ſtrictly adered to, (as recommended for the building the ſhip HALL.) And it gave me great pleaſure, that after her firſt voyage they put her in the Graving-Dock upon ſtraight blocks, to look at her bottom where I obſerved ſhe retained what I call the neceſſary curve of her bottom and keel unaltered, that when ſhe came adry, they put what may be called thin wedges under her keel, fore and aft, to ſupport the curve whilſt in the Dock, as ſhe retained it, though they had ſtowed both her ſteerage and cabin full of Sugar and Rum, which I thought would have altered this curve of her bottom, which I reckon contributes greatly to give ſhips the moſt important good properties, adding to their ſtrength, ſtowing, ſailing, ſteering, ſtaying, and wearing. Therefore I think no pains or expence ſhould be ſpared to try the beſt rules that are the moſt likely to make the ſafeſt, dry, wholeſomeſt, and moſt profitable ſhips for ſea ſervice.

NOT finding ſufficient room to repreſent my ideas for rules to form merchant's ſhips hulls from that drawn by my friend Thomas Mitchel, Eſq. at the top of plate the firſt. I got Mr. Elliot, to draw the ſmall Drafts of the Ship HALL, as particularly diſcribed page 38, and put at the bottom of plate the firſt. But thoſe ſhips deſigned for three deck frigates, will require either her main deck laid lower, or ſome more breadth to anſwer carrying guns.

THE very hard trials theſe two ſhips have met with, and the very extraordinary manner they have bore them, fully confirms me of the very great benefit and advantage their curved bottoms in their length has been to them. Therefore no pains or expence ſhould be ſpared to give this form a fair trial, for I am thoroughly convinced that it contributes very greatly to preſerve them from damage, both a ground and a float.

THE Ship ELIZABETH, happened to meet with a great miſfortune full loaded with rum and ſugar from Jamaica, in coming into our docks with a falling tide, grounded upon a narrow ſhoal ridge, with her midſhip and main body obliquely upon it, when deeper water at both ends, ſhe healed off toward the main deep on her beam ends, and laid a long time quite a dry, ſtr ining ſo much

that they was obliged to nail hides over the weather ſide of her bottom, and had very hard work to get her floated to the quay to diſcharge her, and in the repairing dock found a great many of her futtocks and one flooring broke, yet the curved part of her main body retained its curve, though both ends had ſtraightened ſo that the keel lay fair upon ſtraight blocks. And I reckon if ſhe had been built with a ſtraight floor upon ſtraight blocks as the common practice is, her back would have been broke ſo as to increaſe greatly the expence of her repairs.

THE Ship HALL, this laſt time at Jamaica, in order to increaſe her freight home, after ſtowing her hold and middle deck full of ſugar and rum, ſtowed her main deck full from the fore part of the ſteerage to the fore part of the fore hatch-way, which conſequently lying ſo high above water raiſed the center of gravity, and made her both deeper and cranker than ſhe ought to have been, and in great danger of ſagging the curved part of her main body downward to open the buts as often before mentioned to make her leaky, but I reckon that the preſſure of the water upward againſt it, not only kept her tight but bore this extrordinary weight, that when ſhe was diſcharged, they found had broke all the hold ſtanchions from the after part of the main hatch-way, to the fore part of the fore hatch-way; and two of the hold beams of the lower deck that was reckoned to be ſettled near ſix inches in the middle, and all the ſtanchions and two of the beams of the main or middle deck broke, &c. which ſeems to have occurred to thoſe two ſhips; to confirm, and prove the ſtrength of the principle of theſe curved bottoms, and the advantages attending them both a ground and a float.

On fixing a Ship's Form-Gage to regulate her ſtowage by.

ALL ſhips of any conſequence are built with ſtanchions fixed from the kelſon to the middle of all the lower deck beams fore and aft, in order to ſupport them in their exact regular height, as well as the whole frame of the ſhip in the regular form in which ſhe was built upon the ſtocks. Yet, notwithſtanding theſe ſtanchions, the important and deſtructive facts which have been related, prove from experience, that our ſhip's bottoms hitherto, by the preſſure of water and improper ſtowage, have generally been

been hogged upwards, or ſagged downwards, and moſt about the midſhip frame or main body of the ſhip, which is commonly about the fore part of the main hatch-way, which naturally makes it the only and beſt place to fix the ſhip's Form-Gage, where either the hogging, or ſagging of her bottom may be obſerved and ſeen ſooneſt and beſt, to regulate the ſtowage of heavy materials to the greateſt advantage, ſo as to keep her bottom nearly in the ſame form in which ſhe was built.

THEREFORE, to fix the Form-Gage to the beſt advantage, I would recommend the ſtanchions under the lower deck beam at the fore part of the main hatch-way to be fixed a little ſhorter than the reſt, ſo as to have about a quarter of an inch play at the tenon, or, as it is called, the tennent, at the top; and the Gage to be nailed, or ſcrewed faſt, to the top of the after ſide of the ſtanchion, made of a piece of flat iron about half an inch broad, and a quarter thick, and bent ſo that it may riſe and fall with the ſhip's bottom and ſtanchion freely, up or down, in a ſmall groove made for it perpendicular in the after part of the beam to about half an inch above the upper end of the Gage, to ſave it from being hurt by any thing going up or down the hatch-way; and this after part of the Gage to be graduated, and marked, with a file or cold chiſſel into inches, halves, quarters and eighths of inches, like a carpenter's rule, for a ſtandard mark o. i. ii. iii. iiii. inches upwards to the top of the Gage, and one inch downwards below the ſtandard mark, and a ſmall thin plate of iron, ſuppoſe three inches long, and half an inch broad, let it fair with the beam, and ſcrewed to it with what is called wood ſcrews, right acroſs with the upper edge, exactly even with the ſtandard mark of the Form-Gage when the ſhip is upon the ſtocks; and when ſhe is launched, I do not in the leaſt doubt but that the upward preſſure of the water will act upon the bottom inſtantly, and cauſe the ſtandard mark of the Form-Gage to riſe above the croſs plate, and thus point out plainly the quantity of ballaſt or materials which is required to be ſtowed in the bottom of the main body of the ſhip to counter-act this upward preſſure, and to bring the Gage and bottom to its ſtandard form place, to prevent the tendency to hog the bottom; which is neceſſary even though a ſhip is deſigned to be laid by for a time.

So that it appears to me that if this cheap, eaſy, ſimple method, was fairly tried and duly attended to, as the ſtandard mark of the Gage riſes and falls with the prevailing preſſure, either to hog or

ſag

ſag the ſhips bottom, it would certainly be a guide to point out how ballaſt, heavy cargoes, or materials ought to be trimmed, or ſtowed, more or leſs fore and aft, higher or lower amidſhips in the main body of the ſhip; as will be more particularly recommended hereafter, when treating of ſtowing and trimming of ſhips to the greateſt poſſible advantage for ſafety and ſailing.

And thus by the help of this Form-Gage, we may hope, not only to avoid ſuch deſtructive and fatal conſequences as often attend bad ſtowage; but to anſwer the important purpoſe by good ſtowage, to keep ſhips' bottoms nearly in the form in which they were built, as has been obſerved, which beſides all other advantages above mentioned, will contribute greatly to make them wear much longer, ſtrong and tight ſhips. And the Hall breaking the ſtantions on her middle deck, ſhows a Form-Gage is wanting on the top of that ſtantion as above mentioned.

On HAUSE-HOLES.

THE many diſadvantages I have ſeen to attend hauſe-holes being too ſmall, makes me think it requiſite to mention here, that it is abſolutely neceſſary that all hauſe-holes ſhould be made big enough at firſt; to admit the ſhip's cables, when ſpliced with a ſhort ſplice, to go freely through them.

On fixing the RUDDER.

AS the management of all ſailing veſſels, may be ſaid to depend entirely upon the rudder, to ſteer, ſtay, and ware them, therefore the utmoſt attention is required to have it fixed by the beſt rules which have been found from experience to make it anſwer its important purpoſes to the greateſt poſſible advantage, and not at random as ſhips and veſſels may happen to differ in their breadth abaft, or have more or leſs room for the helm to be put over to make the rudder to traverſe to a greater or leſs angle from the direction of the keel, by which principle it acts to manage the ſhip as occaſion may require. Therefore here I think it neceſſary to remark, that the power of the helm to manage the ſhip depends more

more on her head-way through the water, than on any great angle it can be put to. For when a ſhip has no head-way, the greateſt angle the helm can be put to has no effect upon her; nor when ſhe gets head-way with the helm amidſhips, it does not act with any power, till it is put to an angle from the direction of the keel; then it is that the rudder begins to act, as what is commonly called a ſtop-water, but, more properly, may be called a ſtop-way, by the water acting againſt either ſide of the rudder that is put over, to turn the ſhip's ſtern the other way, in the direction of the tiller, to ſteer and direct her head, as occaſion may require. And in proportion as the helm is put over from the direction of the keel, the rudder ſtops the ſhips head way through the water, and it is well known that no veſſel will ſtay that does not keep her head-way till ſhe brings the wind right a head. Yet I have ſeen in boats, and veſſels of 40 tons and upwards, where the rudder and tiller admitted of it, ignorant people put the helm almoſt right athwart the ſtern in ſtays, which tends more to ſtop the veſſel's head-way through the water, than to bring her head round againſt the wind and waves from one tack to the other, thinking they cannot give the veſſel too much helm in ſtays, and not conſidering that when the helm his put right athwart the ſtern at a right angle with the keel, the rudder then acts only to ſtop the veſſel's way, without any power to turn the ſtern to ſteer her, which proves how neceſſary it is to have the rudder fixed by the beſt rules to prevent ſuch bad practice.

On enquiring what was thought to be the beſt angle for ſailing veſſel's rudders to be fixed to traverſe to, I was told by my friend Mr. Henry Bird, (a great ſhip-builder at the Greenland Dock, London,) that 33 degrees, or 3 points of the compaſs, had been long the moſt approved practice. But many people argued that 45 degrees, or 4 points of the compaſs, would anſwer the purpoſe better, which made me try experiments with a well formed model of a ſhip in a ciſtern of water within doors, with her rudder fixed and marked to traverſe to 4 points of the compaſs. She was puſhed right forward with equal power in one line of direction through the water, firſt with the helm amidſhips, then altered to a point of the compaſs each trial to 4 points; but ſhe made a leſs ſweep and ſhortened her diſtance through the water each point the helm was put over, ſo that ſhe went much farther with the helm amidſhips before ſhe ſtopped, than with the helm fixed at 4 points. But to have it further confirmed that 33 degrees is a ſufficient angle for

for the rudder to traverſe to, having the management of our three long Graving-Docks at Liverpool, where we have in common 10 or 12 ſhips at a time repairing and cleaning, I took the opportunity with a bevel to try the traverſe of many ſhips rudders, Dutch as well as Engliſh, both full for burden, and ſharp for ſailing, and found none to traverſe 33 degrees, but moſtly about 30 degrees, and ſeveral about 28 degrees, and have often obſerved ſmall veſſels that had long tillers came over the top of their round-houſes which could not traverſe above 20 degrees. From theſe remarks I think we may draw a concluſion, that 33 degrees is a ſufficienr angle for the rudder to traverſe to, and ought to be fixed for the beſt rule. And the beveling of the fore part of the rudder and its bands ſhould all be made to admit of that angle, which may give the utmoſt power to the helm to govern the ſhip to the greateſt advantage on important occaſions, becauſe the ſafety of the whole often depends upon it.

THE rudder of the above mentioned ſhip, HALL, was tried and found fixed at this angle, with three inches of the main and three of the falſe keel, (ſix inches in all) going under the fore part of it, as before related.

THEREFORE, by what ever method a ſhip is deſigned to be ſteered, ſtops ſhould be put to prevent thoughtleſs people, as abovementioned, from ſtraining things to put the helm further over than 33 degrees, or 3 points of the compaſs. And as ſhips are ſometimes loſt, by loſing their ſteerage in narrow channels, from having their rudders unſhipped by ſtriking upon the ground, I thought it fair to relate an inſtance we had at Liverpool of a ſhip being loſt by the loſs of her ſteerage, though her rudder was hung in the manner diſcribed in the firſt Edition, page 17, as practiſed at Parkgate, near Cheſter, with eyes in the bands of the rudder, as well as thoſe on the ſternpoſt, with a long iron bolt to go through them, which permitted the rudder to riſe about 20 inches when ſtriking upon the ground. This ſhip, coming into Liverpool too early of the tide, ſtruck upon the Bar and beat over it, but got ſo much damage that ſhe filled with water; the rudder, as expected, did riſe in ſtriking without unſhipping, but bent the long iron bolt crooked into bights, ſo that it would not traverſe to ſteer the ſhip on ſhore in the river, when ſhe might have been ſaved, but ſhe was drove above the town in deep water, and totally loſt.

THIS

THIS inſtance, I think, is a ſufficient proof that this Parkgate method of hanging the rudder did not anſwer the deſigned purpoſe, and that it is therefore beſt to continue the common practice to hang them with what I would call rudder-bands, whether made of iron or braſs; with eye-bands upon the ſternpoſt, and pointed bands upon the rudder, (a name more proper than that obſcene one we commonly give them,) and to prevent the rudder as much as poſſible from unſhipping by ſtriking upon the ground. I would not only recommend it to be well wood locked, but alſo not to be made ſo long, and to go ſo low, as to be in the ſame line with the lower part of the keel, as cuſtomary; for it ſhould be conſidered, that ſhips commonly ſwim by the ſtern, and that, in a rough ſea, it is with the 'ſcending motion that they ſtrike the ground aft firſt, and the after part of the rudder, being loweſt, muſt naturally in proportion be the firſt part that ſtrikes hardeſt, which unſhips or breaks it. Therefore the fore part of the lower part of the rudder ſhould go no lower than within 6 inches of the lower part of the keel, and the after part than within 8 or 10 inches; and the after part of the keel ought to project about 6 inches under the fore part of the rudder, and to be rounded at the after end: the having an iron ſtrap juſt before this projecting part of the keel will ſtrengthen it, and be a guard to prevent the rudder from being unſhipped. This I have ſeen put in practice with a common ſized rudder, and, by the commander's report, the ſhip ſteered very well, and kept ropes from getting into the heel.---I have obſorved a common practice in many ſhips, in order to mend their ſteerage, of making their rudders broader: inſtead of uſing a ſolid piece of light wood, they have two battens nailed on each ſide of the flat part of the back of the rudder, not conſidering that the extent of the flat of the after part of theſe battens, and the great vacuity between them, makes the ſhip tow a proportional quantity of eddied water after her, and the particles of water being known to have both attractive and coheſive properties that require force to part them, they muſt therefore naturally retard proportionally both the ſhips ſailing and ſteering; and eſpecially, when the helm is hard over either way, they muſt hinder her ſtern from turning in the direction of the rudder to turn her head as occaſion may require. Therefore when a ſhip requires her rudder to be made broader to mend her ſteerage, I would recommend to uſe a ſolid piece of light fir, which is much lighter than water, and the after part to be rounded to a half circle, as the back of all rudders ought to be, which ad-

mits the particles of water to cloſe on each ſide to the middle, waſhing the others off from the back of the rudder, which muſt help both the ſailing and ſteering of a ſhip. And the cut-water ſhould be rounded in the ſame manner.---To prevent the ſhoulders of the pointed bands upon the rudder from rubbing upon the eye bands upon the ſternpoſt, which makes the helm traverſe hard, inſtead of what I call a blind band upon the ſternpoſt, I have ſeen put in practice a more ſimple method of only a half rounded piece of iron about eighth inches long, one and an half broad and thickeſt at the top, and one inch below, with two nail holes, the flat part to be let into the ſternpoſt about half an inch, to ſtand perpendicular, for the upper pointed band on the rudder to reſt upon the upper end of it, which will keep the ſhoulders from rubbing, equal to a blind band. And I cannot help thinking, that if there was a flat iron bar with holes to faſten it with rank wood ſcrews, it formed to fit to the fore part of the projecting part of the keel, as mentioned for the ſhip HALL. And repreſented in plate the 12th, to form an idea of the make ſhift rudder. And I would further recommend that the lower pointed band of the complete rudder, might be fixed ſo low, that its point might turn as a pivot upon it in conjunction with the upper band as above mentioned, and I would have it formed to be let in even with the wood, and to reach four or five feet forward under the falſe keel to preſerve it from being beat off. And this lower band of the rudder ſo much lower than common, will greatly ſtrengthen its bottom from being hurt by ſtriking aft.

On MASTS and YARDS.

I PROFESS myſelf an advocate for as taunt lower maſts as can be well ſupported on end, and ſhort yards, from the example of ſhips in the coal and timber trades to London, and from the experience I have had of ſhips ſailing faſter upon a wind from ſhortnening their yards, which muſt eaſe them by making every thing lighter, in proportion as the yards are ſhorter. Even the expence is leſs at firſt fitting out, and to the ſhip and every thing aloft in wear and tear afterwards, and in ſailing her with fewer hands.

ALL maſts which are to be made from crooked poles, ſhould be made and fitted to ſtand with the back aft, that is with the projecting

jecting or crooked ends forward, which will make them ſtand upright without that great ſtreſs upon the ſtays, which muſt act againſt all the other rigging, to prevent the maſts' heads from raking too much aft, which is moſt commonly the caſe. And when lower maſts are obliged to be made from ſquare balks which are not thick enough to make them proportionally round, to take only a little of the four corners off is ſufficient for the lower maſt, where neceſſity requires to make the moſt ſtrength from a ſingle balk.

THE method we now practice of having few blocks, and little tophamper aloft, for eaſe and neatneſs, is certainly right, and ſhould be purſued as far as it can be with ſafety; but I would adviſe, not to carry this faſhion to an extreme, by having too many ſhave holes cut in the maſts' heads, for I have known many topmaſts break in the place of the ſhave holes, under the rigging.

A TOPGALLANTMAST going up and down abaft the topmaſts, as I have found from experience, anſwers many good purpoſes in a cruiſing ſhip, and is a great advantage to a ſhip that muſt often turn to windward, as they may be ſtruck, and kept cloſe ſtruck occaſionally, with the whole topſails trip, as repreſented plate the 2d. figure 1.

On SHIPS' SAILS.

THE ſquare ſails, ſuitable to taunt maſts and ſhort yards, as here recommended, will be in proportion, deep and narrow, which will trim and ſtand much fairer upon a wind, than if they were ſhallow and broader; and, if the ſhip's employ require it, will admit of larger ſtayſails; ſuch ſtayſails as are now made with judgment, not to hoiſt too high at the back of the ſquare ſails, to ſhake the wind out of them, but which permit all the ſails to ſtand to great advantage, clear of each other, as may be ſeen in the front plate, where the ſhip is repreſented in a light breeze ſailing cloſe by the wind.

Narrow deep ſquare ſails recommended.

To endeavour to make a ſhip ſail by the wind, and turn well to windward, deſerves the greateſt regard, becauſe ſafety, as well as many other great benefits, depend upon it. The good effects of deep and narrow ſquareſails, cannot be better recommended as anſwering this purpoſe, than by the performance of ſhips in the coal and timber trades to London, though the deſigned properties

in building and fitting theſe ſhips, are burden at a ſmall draft of water, to take and bear the ground well, and to ſail with few hands, and little ballaſt; yet theſe ſhips perform ſo well at ſea, that government often makes choice of them for ſhore ſhips, in the moſt diſtant naval expeditions; and in narrow channels among ſhoals, and in turning to windward in narrow rivers, there are no ſhips of equal burden can match them, which I attribute a great deal, to their deep narrow ſquareſails, which may be preceived to trim ſo flat and fair, upon a wind, that all the canvaſs ſtands full, at a proper angle from the direction of the keel, ſo that the wind goes freely off from the lee leech of theſe ſails, without being much altered in its direction from one ſail to the back of the next, which is not the caſe, when a ſhip's ſquareſails are ſo broad as to overlap each other much, one ſail then ſhakes the next to it, and they extend ſo far to leeward, that the lee ſheets make the after part of the canvaſs, or lee leeches, ſtand rather as ſo much back ſail to ſtop the ſhip's way, or only to preſs the ſhip's ſide down and to leeward, which is the effect of all the canvaſs in a ſhip's ſails, when it does not ſtand at a proper angle with the direction of the keel, when a ſhip is ſailing cloſe by the wind. Where a deal of canvaſs is wanted, to ſail faſt large, the narrow deep ſquareſails have in height, what they want in breadth; and the flying ſails, including the topgallantſails as ſuch, being all of lighter canvaſs, may be made as large as things will admit of, to anſwer this purpoſe in little winds; and when it comes to blow ſo ſtrong, that theſe flying ſails cannot be carried, then the ſtanding ſquareſails will be found broad enough.

I HAD the yards of a frigate-built ſhip ſhortened ſo much, and the mainſail made in proportion ſo narrow, that the maintack was hauled down through iron-bound blocks which hooked to eye-bolts within board, fixed for that purpoſe, and which made the ſail to ſtand much better, and work much eaſier than when at the cheſtree without board.

Foretacks to ſtand as far to wind ward as maintacks

THE foretacks of all ſhips ſhould be made to ſtand by bumkins, or at the cat-heads, &c. as far to windward as the maintacks, by which I have experienced, the foreſails will ſtand as near or nearer the wind, than the mainſail will when trimmed at the ſame angle. For the ſame reaſons, a collier's foretopſail ſtands upon a wind without a bowline, as the wind acts upon the head ſails, without being turned more aft from one ſail to the other abaft it.

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I HAVE taken the angles the principal ſails ſtand at, from the direction of the keel, on board of a ſhip, and of a ſloop, as they have been turning to windward with a pleaſant breeze; the ſhip's mainſail and foreſail, with their topſails and topgallant ſails above them trimmed, and ſtood at three points of the compaſs, which was at juſt half the angle the ſhip ſtemm'd from the direction of the wind, which was at ſix points upon each tack, but the croſs-jackyard at the ſame time required to be braced up to two points, and the mizentopſailyard to a point and a half, ſo that the plain or body of the mizentopſail ſtood at a point and three quarters, or 19 degrees; the mizen ſtood at about a point and a half or 17 degrees, and the ſtayſails between the maſts ſtood at about the ſame angle, 17 degrees, when drawing full, and by the wind. The ſloop ſtemm'd at five points of the compaſs from the direction of the wind, when her mainſail, foreſail, and jib ſtood at about half that angle, or two points and a half from the direction of the keel upon each tack.

The angle ſhips ſtand at when turning to windward

IN ſhips deſigned to cary many ſmall ſails in little winds, I have had the experience of turning to windward with 30 effectual ſails, ſet in a ſimple eaſy manner, and had them drawn, when in real practice at ſea, and they were as repreſented in the front plate. Beſides two jibs, foretopmaſtſtayſail, ſpritſail and ſpritſailtopſail, which are known to ſtand very well upon a wind, we had a fore-ſtayſail ſtood very well by our foremaſt ſtanding well aft, and the foretack well to windward, as before recommended; and by having two ſheaves in each truck, at our long topgallant maſts' heads, we hoiſted the topgallant royals up to the trucks by the ſheaves on one ſide, and the main and mizen ſpindle ſtayſails by the ſheaves on the other ſide of the trucks, at the main and mizen topgallant-maſts heads, we ſet a gaff topſail with a light yard ſlung by the thirds, hoiſted up through a block at the after part of the cap at the mizentopmeſthead, the tack hauled down on the weather ſide, to the after corners of the mizen top, and the ſheet to the gaff end. This ſail was eaſier managed, and ſtood more to advantage, than when ſet with a cumberſome heavy gaff, rigged at the mizentop-maſt head for that purpoſe. We ſet a large driver with a light pole for a boom, with two tail blocks at the ſmall, or outer end, which we run out aft on either ſide, and laſhed it to the rail, ſo that the blocks on the outer end ſtood right aft, facing the middle of the ſtern, upon either tack, the driver ſlung by the third of the yard, like a lug-ſail, hoiſted within about four feet of the end of the

Setting many ſails in an eaſy manner.

the mizen gaff, which was about three feet longer than the mizen required it, on account of this ſail: the tack hauled down to the weather quarter piece on either tack, and the ſheet to the block amidſhips, with a bowline hauled to the mizen maſt, which made the ſail ſtand fair upon a wind, at an angle of about a point and an half, or 16 degrees from the direction of the keel; we ſet a fore-topmaſt ſtuddingſail for a waterſail, the yard ſlung by the third, hauled out to the other tail block at the driver boom end, with the ſtraight leech or the ſheet clue uppermoſt, and made faſt to the weather corner of the ſtern rail, and the lower clue had two ſheets or lines led into the aftermoſt gunport or ſcupper in the waiſt on each ſide, ſo that in tacking when the wind was near ahead, we ſhifted the fore part of theſe ſails to the weather ſide, which trimmed them ready for the other tack, by which means they prevented the ſhip from falling too much off, and had good effect upon her ſailing in a light breeze of wind. But when it came to blow freſh, the wind, reflected from the mizen, ſhook the driver ſo much that we took it in when ſailing cloſe by the wind, and when we rigged in the boom, it lay ſnug fore and aft on one ſide, ſtopp'd to the rail, and was much more out of the way than a cumberſome heavy yard, which is often uſed for a driver boom, and which, lying acroſs, is inconvenient, and holds wind when the ſhip is ſailing cloſe hauled, and can only ſerve to ſet the ſail to advantage, when ſailing with the wind quartering, or before it. But I muſt own the late improvement of the long boom mizen, greatly ſurpaſſes the driver ſailing upon a wind.

On ſailing large with many ſails.

In ſailing any thing from the wind, to right before it, we eaſily ſhifted our driver boom to different parts of the ſtern, and by the heel ropes at the heavieſt end within board, trimmed it as the wind required, ſo as to make the driver and water-ſail ſtand as fair and as far, or farther, out from the ſhip, as could be done by a yard acroſs for a boom, as abovementioned. We ſet topgallant ſtudding ſails, without troubleſome and comberſome booms on the topſail yards, by having thimbles fixed at the outer end of the topmaſt ſtudding ſail yards, we kept the tacks reeved and both ends made faſt to the inner yard-arm, ſo that they could be come at from the topſail yard-arm to bend the tack and haul it out, which ſpread the ſails and made them ſtand very well, and ſhewed with the driver and water-ſail as in plate the 1ſt, where the ſhip is repreſented ſailing with all ſails ſet, with the wind quartering. But I muſt own we were obliged to ſtop the inner yard-arm of the topmaſt ſtudding

ſtudding ſail, with the outer gaſket of the topſail yard-arm, when the ſail was ſet abaft the topſail, to prevent the outer yard-arm from flying forward.

IT is ſaid that we have ſhips that will bear and carry ſail ſo as to get to windward, or keep clear of a lee-ſhore, as long as canvaſs will ſtand. In ſuch a caſe ſafety muſt often depend upon the ſails, therefore the method of making them ſhould have all the ſtrength that can be given to prevent their ſplitting in times of danger.

Sails how ſtrengthened in the making.

IT would contribute greatly to make canvaſs ſtand a ſtorm, and wear much longer, if the ſails were made with roband, grommet, and point holes, in the middle of every ſeam, and about half an inch lower down in the ſail, than thoſe holes that are found neceſſary to be between the ſeams, and which fall in the ſingle part of the canvaſs. By this method the greateſt ſtrain will be upon the ſeams, which are the ſtrongeſt parts of a ſail, and will bear a greater ſtreſs than they will by the preſent practiſe of making all the above holes in the ſingle part of the canvaſs, clear of the ſeams, which is done to avoid as I ſuppoſe, cutting and ſewing through ſo many folds of canvaſs; for there is now made about the ſame quantity of holes as I would wiſh to recommend here, that is, a hole in each ſeam and one midway between, which is enough for any ſail, and for the ſail that reefs by the foot, a point hole in each ſeam is found ſufficient.

I HAVE tried to manage the ſails in a cruſing veſſel, and in cod-ſmacks when fiſhing, with robands and points in the ſeamed parts of the ſails only, in order to reef and unreef them with more expedition, and lay the more ſtreſs where the principal ſtrength of the ſails lay, but found from experience that it requires robands and points in the middle part of each cloth, to confine the ſails cleverly to the yards and gaffs; therefore the holes that are made in the ſingle part of the canvaſs ought to be a little higher up in the ſail, that the principal ſtreſs may be upon the ſeams which I reckon is about three times as ſtrong as the ſingle part of the canvaſs. When the ſail is ſeam-pricked, as all the foul weather ſails ought to be, in a zigzag or ſerpentine manner, as ſoon as they are ſtretched a little by wear, if the ſails are not confined to the yard, ſtays and gaffs, more by the ſeamed part of the ſail than by the ſingle canvaſs, the weight of the ſeams will contribute to ſplit and wear out the ſingle canvaſs much ſooner, eſpecially when the ſails flap hard in gales of wind, or when obliged to carry ſail in little wind with a great rolling ſea.

INSTEAD of cutting theſe holes through ſo many folds of canvaſs at random with a knife, I take the liberty to recommend to have a round hollow tool or gouge with a mallet, and a block upon the knees, for the purpoſe of cutting the holes more regular. But it is in this as in other propoſed improvements. It is difficult to get people out of the common practice, and ſome tradeſmen have ſuch contracted notions, and not aſhamed to ſay it, that the ſtrength of work is the decay of trade. But in all things belonging to ſhipping encourages trade in general amongſt us. And I would have all well paid for uſeful improvements.

On RIGGING and ROPES.

WE ſhould avoid all unneceſſary rigging, as well as blocks, for every thing that the wind blows upon, about a ſhip, which does not ſtand in the place of direction with the ſails, is a hindrance to the ſhip's ſailing upon a wind, therefore the running rigging ſhould not go double, where ſingle will anſwer the purpoſe. The cloſe net-work with bobs, which I have ſeen hanging under the fore part of ſhips' tops is uſeleſs tophamper and crow feet there, and in my opinion, does more harm than good.

Ropes above ſix inches to be cable laid.

I WOULD adviſe to have all ropes above ſix inches round, to be cable (or double) laid, that is with nine ſtrands, inſtead of three, with the ſame number of yarns; for reaſon as well as experience teaches us, that in all ſingle or ſhroud-laid ropes with three ſtrands only, and above ſix inches round, the out-ſide yarns in each ſtrand are ſtrained in making the rope hard enough, by being worm'd or twiſted round at ſo great a diſtance from the centre, that the yarns about the middle of the ſtrands are by that means made to be ſlack, ſo that before they come to bear a ſtrain, the outſide yarns muſt be broke. That this is a fact may be preceived when opening a ſtrand of a large ſhroud-laid rope; one ſees there the inſide yarns are drawn up ſlack when the outſide yarns are worn out and broke; for which reaſon I would recommend the ſtanding rigging, above ſix inches, to be cable-laid, with the ſame quantity of yarns, which will be ſtronger than the ſhroud-laid rope, in proportion, as all the yarns lie in a ſtraighter direction with the length of the rope, conſequently, they all bear the more equally a part of the ſtrain.

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I HAVE tried the ſtrength of a number of threads together, made faſt to a ſcale beam, 1ſt, laid in a ſtraight direction, without any twiſt, like to a ſelvage; 2d, the ſame number moderately twiſted; 3d, an equal quantity twiſted more, and I found from repeated experiments, that thoſe with the moderate twiſt, bore the greateſt weight before they broke, and that a number of threads joined to gether will not bear a proportional weight to one of them ſingly, that is, ten threads comes a great way ſhort of bearing ten times the weight that one thread bore ſingly, and hence I conclude, the caſe is the ſame with a rope and one of its yarns.

Hints for Supporting Ships Maſts with Eye-bolt Chains, inſtead of Hemp-rope for the ſtanding Rigging.

THE very great ſtrain I have ſeen eye-bolts bear on board ſhips, makes me think that their maſts may be ſupported by eye-bolt chains to great advantage, inſtead of rope which is now grown very dear in proportion to iron.

EXPEREMENTS might be eaſily tried to confirm or confute this opinion, by taking, ſuppoſe three fathoms of ſhrowd rope, and make three fathoms of eye-bolt chain, made of ſuch tough iron as the whale harpoons are made from the ſame weight as the rope, ſuppoſe the links of the chain to be two or three feet long, according to the ſize of the ſhip, the longer they are made, the lighter the ſhrowds and ſtays will be, bend them together and try with ſufficient power, which ſtretches moſt and breaks firſt the rope or the chain.

IF the chain gains the preference in lightneſs and ſtrength without ſtretching, I would recommend an iron plate, ſuppoſe half an inch thick, or more according to the ſize of the ſhip, to be worked together ſo as to lie fair and flat, juſt broad enough to cover exactly the upper four ſquare part of the threſtle-trees that exactly fit the maſt heads, with four holes to be bolted there, and long enough to be bent downwards on each ſide pointing to the dead eyes below, with holes big-enough that the upper link of each ſhrowd may be hooked to and mouſed, and one hole on each ſide above them at the fore parts of the plates for long links for the collars of the ſtays to be hooked to and mouſed, as repreſented in plate 12th, drawn from a model which I got made, and rigged

her lower maſts with wire links and thread lanyards, ſet up the ſhrowds and ſtays to their proper tightneſs, for the opinion of profeſſional men, who allowed that ſhip's iron futtock plates would wear them out, and no doubt but a ſet of this ſtanding rigging would do the ſame, if it was found from fair trial to anſwer its purpoſe. And as to preventer and ſtay-ſail-ſtays they may be of rope and go under theſe ſtays as uſual.

Theſe hints I cannot help thinking deſerve the conſideration of profeſſional gentlemen that have power in our incomparible Royal Navy, where ſuch experiments ſhould be firſt tried to bring them into uſe, for I reckon they would be proof againſt the fire of ſmall ſhot, and if broke by large ſhot, having ſpare eſſes made for links, the damage might be ſoon repaired, and might be contrived to make them conductors of lighting from the maſt heads into the water alongſide.

If this hint ever meets with approbation powerful enough to give a fair trial, I would recommend to prevent the iron links from ruſting, and feeling too cold in very cold weather for the hands going up and down the ſhrowds; to have the links well tarred and ſerved over with ſpunyarn, or ſowed over with tanned horſe-hide, &c.

ON STOWING AND TRIMMING A SHIP.

A SHIP's ſailing, ſteering, ſtaying and waring, and being lively and comparatively eaſy at ſea in a ſtorm, in my opinion, depends greatly on the cargo, ballaſt, or other materials being properly ſtowed according to their weight and bulk, and the proportional dimenſions of the ſhip, which may be made too crank, or too ſtiff, to paſs on the ocean with ſafety. Theſe things render this branch of knowledge of ſuch conſequence, that rules for it ought to be endeavoured after, if, but to prevent, as much as poſſible, the danger of a ſhip overſetting at ſea, or being ſo labourſome as to roll away her maſts, &c. by being improperly ſtowed, which is often the caſe, which appears to me to be one of the moſt difficult and eſſential matters that concerns the management of ſhips, therefore deſerves proper encouragement for learned men of ſcience to endeavour, to account for from fixed principles, and to give reaſons, why ſhips, or the ſame ſhip, may be thus differently affected by ſtowage,

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ſo as to inſtruct ſeamen in this moſt important point of duty, becauſe, ſucceſs as well as ſafety, may greatly depend upon it; for it is known that our government has had two ſhips of war built by the ſame ſet of moulds, fitted in the ſame manner, and with the ſame materials, as near as poſſible, yet one ſhip anſwered much better than the other. This can only proceed from different management, which induces me, (ſailor-like), not to halt before I find my ſelf quite lamed, but to puſh forward, at all hazard, to endeavour to explain what I know, from experience and obſervation; which I hope will be found of ſome ſervice, if it only induces others more capable, to conſider and treat this moſt important ſubject, with that attention, and to that extent, it deſerves.

WHEN a ſhip is new, it is prudent to conſult the builder, who may be ſuppoſed beſt acquainted with the ſhip of his own planning, and moſt likely to judge what her properties will be, to adviſe how the cargo or materials, according to the nature of them, ought to be diſpoſed of to advantage, ſo as to put her in the beſt ſailing trim; but I would recommend trials at every favourable opportunity afterwards, to find out or to confirm which is the beſt trim of a ſhip for ſailing; as experience is the only guide, when ſcience does not point it out.

Experience the only method for finding a ſhips beſt ſailing trim.

I WAS in a fine ſhip which did not ſail to expectation, and the fault was always laid on her not being ſtowed to ſwim at her propoſed trim, which was ſo much by the ſtern, that a full part coming into the water aft near her loaded mark, prevented her ſtowing the cargo ſo as to bring her to that deſigned trim, but when the experiment came to be tried, to ſwim her more upon an even keel, ſo as to keep the too full part more out of the water, the ſhip then ſailed much better. I have been cruiſing in concert with a ſhip that we out-ſailed every way, but by their taking their anchors from her bows and ſtowing them abaft the bits, it gave her ſuch advantage that ſhe out-ſailed us after that, both by the wind and large. Being appointed from our Pilot's Committee with Mr. Bryan Blundell, Merchant, who had been a great and ſucceſsful ſhallop-racer in the Weſt Indies, to go with two of our Pilot ſloops and Pilots to ſurvey our neighbouring ports, to fix rules to examine our Pilots by; the ſloop we happened to be in was the worſt ſailor of the two: Mr. Blundell ſaid he would make her ſail better than the other without meddling with the maſt, ſails, or rigging, or trimming her more by the head or ſtern, which he did by

by getting the Pilots to move the heavieſt looſe materials from fore and aft into the main body amidſhips, which anſwered the deſigned purpoſe, and made her beat the other ſloop as much as they beat us before. I was in a common merchant ſhip deep loaded with lime-ſtone amidſhips from Liſbon to the Weſtern Iſlands, where we found her a match in ſailing with one of our Liſbon Packets, which are built for ſailing only; but we were very leaky at the ſame time, which, I reckon, was owing to her bottom being ſagged downwards amidſhips by the weight of the ſtone lying there. And I was told of a maſter of a veſſel that carried iron-ore, who uſed to ſay, "when we are loaded with iron-ore we beat every body, but when not loaded with iron-ore every thing beats us," which tends greatly to confirm the advantages of curved bottoms, as well as heavy materials ſtowed towards the main body, for ſailing faſt. But care muſt be taken not to ſagg down their bottoms too much to open their buts, as mentioned page 15.

What ſort of ſhips require different management in ſtowing

SHIPS muſt differ in their form and proportional dimenſions, and to make them anſwer their different purpoſes, they will require different management, in the ſtowage, which ought not to be left to mere chance, or done at random, as goods or materials happen to come to hand, which is too often the cauſe that ſuch improper ſtowage makes ſhips unfit for ſea, therefore the ſtowage ſhould be conſidered, planned, and contrived according to the properties of the ſhip, which, if they are not known, ſhould be enquired after. If ſhe is narrow and high-built in proportion, ſo that ſhe will not ſhift herſelf without a great weight in the hold, it is a certain ſign ſuch a ſhip will require a great part of heavy goods, ballaſt, or materials laid low in the hold, to make her ſtiff enough to bear ſufficient ſail, without being in danger of overſetting. But if a ſhip be built broad and low, in proportion, ſo that ſhe is ſtiff and will ſupport herſelf without any weight in the hold, ſuch a ſhip will require heavy goods, ballaſt, or materials ſtowed higher up, to prevent her from being too ſtiff, and labourſome at ſea, ſo as to endanger her maſts being rolled away, and the hull worked looſe, and made leaky,.

I SPEAK from experience, having been in ſhips of both extremes; ſome too crank, and others too ſtiff and labourſome at ſea; and I have been in company with a ſhip ſo ſtowed, as to be ſo crank as proved fatal to her and her crew; which laſt is the moſt dangerous of the two extremes.

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THE facts I related from experience, page 30, ſhew that there muſt be a medium from the beſt proportioned breadth of a ſhip, according to her deſigned trade, and which ſhould be endeavoured after, that ſhe may be ſo ſtowed as to prove neither too crank nor too ſtiff, and which is ſuch as to admit the ſhip to yield or heel to her ſails, when the maſts are in danger of being carried away by being overpreſſed: for that ſhip is ſufficiently ſtiff for any purpoſe, that will bear to carry away her maſts before ſhe will overſet. If this trim could be hit upon, by any rules for the conſtruction and ſtowing of ſhips, it would be of great advantage to make them paſs through the ocean with more eaſe, and conſequently, leſs damage, for the over-ſtiff ſhip, when preſſed hard with ſail, ſtrains every thing imperceptibly to a dangerous degree, and to guard againſt her maſts being carried away, obliges to keep a conſtant looking up, to ſee how much they bend, which cannot be ſo much attended to, as when the ſhip heels in proportion as ſhe is overpreſſed, which gives the ſureſt warning to take in the ſail in proper time.

The medium to be endeavoured after.

IN order to help a ſhip's ſailing, that ſhe ſhould be lively and eaſy in her pitching, and ſcending motions, it ſhould be contrived by the ſtowage, that the principal and weighteſt part of the cargo, or materials, ſhould lie as near the main body of the ſhip, and as far from the extreme ends, fore and aft, as things will admit of. For it ſhould be conſidered, that the roomy part of our ſhips, length-ways, forms a ſweep or curve, near four times as long as they are broad, therefore, thoſe roomy parts at, and above the water's edge, which are made by a full harping, and a broad tranſom to ſupport the ſhip ſteady, and keep her from plunging into the ſea, and alſo by the entrance and the run of the ſhip, having little or no bearing body under, for the preſſure of the water to ſupport them, of courſe, ſhould not be ſtowed with heavy goods or materials, but all the neceſſary vacancies, broken ſtowage, or light goods, ſhould be at theſe extreme ends fore and aft; and in proportion, as they are kept lighter by the ſtowage, the ſhip will be more lively to fall and riſe eaſy in great ſeas, and this will contribute greatly to her working, and ſailing, and to preſerve her from ſtraining and hogging, for which reaſon I think it a wrong practice to leave ſuch a large vacancy in the main hatchway, as is uſual to coil and work the cables, which ought to be in the fore or after hatch-way, that the principal weight may be more eaſily ſtowed in the main body of the ſhip, above the flatteſt and loweſt floorings,

The weighteſt part of the cargo, or materials, ought to lie in the main body of the ſhip

floorings, where the preſſure of the water acts the more to ſupport it, as mentioned page 10, on the preſſure of water.

On the Centre of Cavity, Gravity, and Motion of a Ship.

THESE are fundamental points which certainly exiſt in a ſhip; and her trim, as laſt mentioned, depends upon their places, but ſo little are they underſtood, as I have been told, that a great ſea officer was heard to ſay, when his ſhip was labouring hard in a rough ſea, how ſhould ſhe but roll when ſhe had ſo much tophamper? which was aſcribing the effect to a wrong cauſe, and is what will be often the caſe till the fundamental principles are known; I am therefore emboldened to endeavour to communicate what I have learned of theſe difficult points, hoping an abler pen, will ſome time undertake to amend and make up my defects, in the knowledge of theſe points, ſo that they may become uſeful to ſeamanſhip.

On the centre of cavity,

THE centre of cavity of a ſhip, is a point in the middle of the hold, or hollow part of the hull, which ſupports her loading and her materials, but it is in reality the cavity, or the centre of the bearing part of the ſhips' body, that is immerſed in the water, that acts to ſuppport her in all the different ſituations, and motions a ſhip is ſubject to, which occaſions this centre of the cavity immerſed, to be always ſhifting its place; as the different parts of the ſhip's hull happen to be in the water, it moves from being about the midſhip, when the ſhip ſwims upright and upon an even keel, to forward or aft, as the ſhip is trimm'd more by the head or ſtern, and from one ſide to the other, in proportion as the ſhip is made to heel.

And centre of gravity.

THE centre of gravity of a ſhip, is a place ſome where in her, where the wheight of the whole ſhip, cargo and materials, in and about her is brought to a point: when the ſhip ſwims upright and upon an even keel, it is ſome where in a middle line of direction from the ſtem to the ſternpoſt, where another line would croſs it about the midſhip frame, from one ſide to the other, and if the ſhip could be ſuſpended in air on this point, ſhe would remain there in whatever poſition ſhe was put into,

BUT the centre of gravity of a ſhip, is always liable to alter its place, higher or lower, more forward or aft, on one ſide or the other,

other, according to the ſtreſs or weight that happens to be laid upon the different parts of the ſhip or her materials, not only by the management of the ſtowage, but by the power and preſſure of the waves and wind.

Why a ſhip overſets and what ſupports her from overſetting.

THE centre of gravity of a ſhip, as in other heavy bodies, has always a tendency to deſcend to wards the center of our globe, whether the ſhip is on ſhore or afloat, if it is not prevented from falling by the baſe or bottom, that ſpreads without this point to ſupport it. For whenever it happens that a ſhip is laid on ſhore, and heels ſo much that the centre of gravity over hangs that part of the ſhip's bilge, upon the ground, that ought to ſupport it, the ſhip will be ſure to tumble over, if not prevented by ſome means. And when a ſhip is afloat, if ever ſhe heels ſo much, that the centre of gravity goes farther over to one ſide than the centre of cavity, or the middle of the bearing part of the ſhip's body then immerſed in the water, the ſhip will overſet; but whilſt the centre of cavity immerſed, goes faſter and farther over to the ſhip's ſide, in her motions, ſo as to keep without the perpendicular of the centre of gravity, the ſhip will be ſupported from overſetting, and the water will act upon the centre of cavity immerſed, in proportion to its diſtance without the centre of gravity, with more or leſs power, to bring the ſhip upright again, as ſoon as the force of the wind or waves ceaſes, or the power or weight is taken off or ſhifted, that occaſioned the ſhip to heel or turn on one ſide. And it is well known from the experience of heaving ſhips down, that according to their proportional dimenſions they require different management; thoſe built low and broad requiring ſo great power as to endanger the maſt, (*which is the lever*, and on which the great ſtrain lies,) owing to the centre of cavity immerſed, (*which is the prop* that the veſſel turns upon on this occaſion,) lying ſo far without the centre of gravity; and this it is which cauſes ſo great a ſtrain on all the materials uſed to raiſe the centre of gravity, to heave the keel out: and if built high and narrow, by reaſon of the centre of gravity ſoon overhanging the centre of cavity immerſed, a ſhip requires relieving tackles to be fixed ſo, as to eaſe her down, and prevent her overſetting, and to raiſe her upright again: ſo that the poſition of the centre of cavity with reſpect to the centre of gravity, is what regulates all the motions of ſhips, when afloat.

THE centre of motion of a ſhip, depends upon the places of the centre of cavity and gravity, as laſt mentioned, and as they alter,

On the centre of motion.

alter, the centre of motion ſhifts its place, but in ſhips, as in other heavy bodies in motion, this point always endeavours to be at the ſame place with the centre of gravity, and it is really ſo, when the centre of gravity is above the ſurface of the water, and the ſhip is afloat; but when the centre of gravity is below the ſurface of the water, and the water ſmooth, then the centre of motion is at the water's edge, which I found by experiments which I made with models of ſhips, about three feet long, in a trough of water.

Experiments on models of ſhips to find out their center of motion.

I FIRST tried a model that was made exact from a draft well deſigned for a faſt ſailing ſhip, with a rounding bottom, as has been recommended; it was quite light, and had only a mainmaſt in, to heel her by, ſhe ſwam upright, and drew three inches water aft, and two forward; I then ſtuck pins in, at the water's edge, in the middle of the ſtem and ſternpoſt, then heel'd her gunnels in, by the mainmaſt head, which cauſed the pins in the ſtem and ſternpoſt to riſe out of the water, and form the ſweep upwards, and made it evident the centre of motion was higher up: then I tried where her centre of gravity was, by ſuſpending her in air, between two pointed irons, in the middle of the ſtem and ſternpoſt, and found it about an inch and an half above the pins, at the water's edge, and found the points of ſuſpenſion on each ſide, about the ſame height above water amidſhips: I ſtuck pins in theſe four points, pointing to the centre of gravity in the hold, and I found by repeated trials, that theſe upper pins or points, were the axis or the centre of motion that ſhe turn'd upon; when making her heel and roll, thoſe upper pins in the ſtem and ſternpoſt had little or no motion, whilſt thoſe pins at the water's edge, roſe out of the water as ſhe moved from ſide to ſide; and when ſhe was made to pitch and 'ſcend, by preſſing her down fore and aft, thoſe pins on each ſide amidſhips, ſeemed to have little or no motion, whilſt I confined them as ſteady as poſſible to a point.

I LOADED the ſame model with lead, till ſhe drew four inches and a quarter water fore and aft, and there ſtuck in pins at the waters's edge, in the ſtem and ſternpoſt, and found the centre of gravity, two inches and a quarter below theſe pins; then heeling her in the water, gunnel in, each way as before, I found the pins in the ſtem and ſternpoſt, to continue at the ſurface of the water. I raiſed the lead higher up in the hold, till I found the centre of gravity at the water's edge, then heeling her in the water as before, found the centre of motion at the ſame place. I raiſed the lead

ſtill

ſtill higher, till the centre of gravity was about half an inch above the pins, at the water's edge, then the model would juſt bear herſelf from overſetting. In this trial the centre of motion was at the ſame place with the centre of gravity, about half an inch above the ſurface of the water.

I TRIED a model of a high full built ſhip, that was rigged, and had guns upon deck, ſo that ſhe would juſt ſupport herſelf from overſetting, ſhe drew five inches water forward, and ſix inches and a half aft. I ſtuck pins in the middle of the ſtem and ſternpoſt at the water's edge as before, and found the centre of gravity fore and aft, an inch and a half above theſe pins at the water's edge. I there put in pins, and tried by heeling her in water as above, and found at theſe upper pins was the centre of motion, or axis that ſhe turned upon, which will always be the caſe, when the centre of gtavity is above the ſurface of the water. An inſtance of a ſhip launched, agreed with and confirmed the above experiments.

A MERCHANT ſhip built with a high and ornamented top, upon a ſharp bottom, having her lower maſts in, and rigged when ſhe was launched, and, as is common at ſuch times, having a great many people upon deck, all theſe raiſed the centre of gravity ſo high, and the centre of cavity immerſed lay ſo low in her ſharp bottom, when ſhe came into the water, that it would not ſupport her upright, but ſhe ſallied and laid down on one ſide, with the black ſtrake above the bends amidſhips in the water, this frightened the people upon deck, and all getting upon the upper ſide, ſhe then ſallied and rolled over as low the other way, and the people as before ſhifted themſelves to the contrary ſide, which made her keep conſtantly thus ſallying, whilſt they towed her with boats about half a mile, and got to one of our dock quays, where the people gladly got out of her.

The center of motion ſhewn by the launching of a ſhip.

SHE was launched without her rudder, and I had the opportunity of ſtanding near her, and obſerved a boat under her ſtern that was held by a man with the boats ſtem cloſe to a rudder-band, about three feet above the water's edge, which rudder-band I perceived to have little or no motion, but was the axis of the centre of gravity, and motion, that ſhe turned upon, while ſhe was ſallying or rolling, with her upper works in the water, which I reckoned was as high above the water, as the keel was under water amidſhips, when the ſhip was upright.

CAUSES and effects are beſt diſcovered from experience and obſervation, and from theſe we muſt find out true principles. This ſhip's ſharp bottom in the water, when ſhe was upright, made too ſmall a baſe, and the centre of cavity lay too low to ſupport her upright, with the centre of gravity lyiug ſo high above water, that it made her ſally or lie down on one ſide, till that brought a broader baſe into the water, and the centre of cavity (then immerſed) was higher up, and farther over, and without the centre of gravity, ſo that the centre of cavity then immerſed, became as a prop, to ſupport the ſhip from going lower, as ſhe ſallied each way, and in this caſe, the centre of cavity was the centre of motion, that ſhe turned upon, when her ſide was laid down; for all the weight and power that was without the centre of cavity acted as a lever, the ſame as when ſhips are hove down keel out, which lifted the centre of gravity a little, as ſhe ſallied, which ſoon preponderated again, and the people always moving over to the upper ſide, accounts for this ſhip's ſallying in this manner.

The center of gravity and motion are at the ſame place in great ſeas, and a ſhips behaviour depends upon that place.

THIS ſhip's behaviour, and the above experiments, in my opinion, make it evident, that the centre of motion of a ſhip, is at the centre of gravity, and according to the form and proportional dimentions of the ſhip, and her centre of gravity being higher up or lower down, the different properties or behaviour of ſhips may be accounted for. From the conſtruction of the above ſhip, when loaded with refined ſalt, that juſt filled her, the centre of gravity being then at a great height, the report of her performance at ſea was that ſhe anſwered very well, and was remarkably eaſy in her rolling motion, in great ſeas, though the ſpectators, at her launching, expreſſed themſelves, that they would be loath to go in her to ſea, on accout of her rolling.

Heavy bodies turn in ſwift motion upon their centre of gravity and bring their heavieſt end foremoſt.

IT is a known property of all heavy bodies, forced into quick motion through air, or water, that they turn upon their centre of gravity as their centre of motion. I have ſeen a bomb ſhell turn round in the air, by the centre of gravity being near the middle: and where the centre of gravity lies near one end, that heavieſt end will go foremoſt in all directions, upwards, as well as downwards, as may be ſeen in ſkyrockets, and arrows ſhot from bows; an arrow ſhot with the light end upwards, immediately turns upon its centre of gravity for its centre of motion. The ſame cauſes produce the ſame effects upon ſhips, when by high mountainous ſteep waves they are toſſed up and down, with a violent quick motion.

IT muſt be allowed that there is a point in a ſhip which may be called the centre of motion, and which ſhe turns upon, conſequently

ſequently it has leſs motion than any other part of the ſhip, when rolling, pitching, 'ſcending, or in any other motion a ſhip is ſubject to, in great ſeas, when its place is then at the centre of gravity, which lying higher, or lower, according to the form and dimentions of the ſhip, contributes to make her comparatively eaſy, or uneaſy and very labourſome, in high waves.

Reaſons why a well proportioned ſhip may be eaſy or uneaſy.

SUPPOSE that in a well proportioned ſhip for carrying cargoes in general, when loaded, the centre of gravity and motion were even with the ſurface of the water, this would make her remarkably eaſy in her rolling in great ſeas. And again, ſuppoſe the ſaid ſhip without dennage, to be loaded with lead, which is eleven times heavier than its bulk of water; in a ſmooth ſea, this might ſeem a benefit by making her extraordinary ſtiff upon a wind, and what little ſhe was made to heel to her ſail, would turn upon the centre of motion at the water's edge, but if ſhe ſhould meet with great ſeas, ſo that ſhe muſt riſe and fall, in proportion to the height and quickneſs of the waves, that would give liberty for the centre of motion to act with its natural tendency to the centre of gravity, which by this ſtowage would be laid ſo low that the ſhip would roll away her maſts, and be in danger of foundering, by working her hull to pieces.

The properties of a collier cat, loaden with timber.

FOR a further confirmation of the above opinion, I examined into the properties of a collier cat, of about five hundred tons burden, that carried her loading of Riga timber, without any ballaſt in the hold, who had about a ninth part of her cargo upon deck and on the quarters, and was ſufficiently ſtiff, and remarkably eaſy in her rolling, in great ſeas, compared to what ſhe was, when loaden with Newcaſtle coal, though ſhe carried herſelf full of them, yet ſhe was then remarkably labourſome in her rolling. And this difference may be accounted for, from the above principles, for when this ſhip was loaded with Riga timber, which is lighter than its bulk of water, it was computed, that about a third part of her cargo lay above the water's edge, at her loaded mark, which would bring the centre of gravity and motion as high as the ſurface of the water, when ſhe drew about ſixteen feet amidſhips; from thence to the upper part of the rigging at the main-top-gallant-maſt-head, meaſured 108 feet, which is ſome what leſs than ſeven eighth parts of the whole, above water; and above the centre of motion; and is more than one eighth part under water, and below the centre of motion. And what made her ſufficiently ſtiff, was, her extraordinary breadth, and the tight free board, or

upper works, above the loaded mark, that ſupported the centre of gravity ſo high, and that occaſioned her to be ſo remarkably eaſy in her rolling, as the water and the waves acted at the leaſt diſtance, and with the leaſt power poſſible, above the centre of motion, on that ſmall part of her hull above her loaded mark, to move, and give any degree of violent rolling motion, to ſo large a part of her body, that was under water, and below the centre of gravity and motion; for what her keel was made to move ſide ways, her top-gallant-maſt-head had a little leſs than ſeven times more to move in the ſame time, therefore her rolling motion muſt be much leſs, and eaſier in great ſeas, than it would be, if ſhe was loaded with coal, which is heavier than its bulk of water, and would make the centre of gravity and motion lie ſo much lower down in the hold, ſuppoſe four feet below her loaded mark when ſhe drew ſixteen feet water. In this caſe, the water is perpetually acting with an additional power, on that four feet of the cavity of the ſhips hull, that is immerſed above the centre of gravity, to ſupport the ſhip, and make her ſo much ſtiffer, to carry more ſail upon a wind with an upright ſide, in ſmooth water, as before mentioned. And the ſame cauſe will make her more labourſome in great ſeas, when ſhe comes to be lifted up, with a ſwift motion, from the bottom to the top of a high ſteep mountainous wave, that may break in upon deck at the ſame time, as repreſented, plate the 6th, on ſhips lying to. The aſcending ſide of the waves in this caſe acts, with an additional power, to turn the ſhip bodily more on her lee ſide, in proportion as the center of gravity and motion lie lower, than when loaded with timber, and at the ſame time like other heavy bodies in motion upwards, ſhe has a great tendency to turn her buttom more up, as the centre of gravity lies lower, as mentioned page 67. And in proportion, as theſe combin'd cauſes have turn'd the ſhips weather ſide up, at the top of the wave, which then leaves the weather ſide, with more of the bottom lower down, without water to ſupport it, which muſt naturally fall on the deſending ſide of the wave, they now act on the lee ſide of the ſhip, to turn and plunge the weather ſide deep into the hollow of the next wave, which will act as before, to give the ſhip more violent rolling motions, according to her breadth, and the height the waves have to act upon the ſhip's hull, above the centre of gravity, and motion, which now lies a little leſs then a tenth part, from the keel to the top-gallant-maſt-head, ſo that for every foot her keel is made to move by the above

The difference of being loaded with timber and coal.

powers,

PLATE 6th.



Billinge Sc. Liverpool.



powers, ſideways, the maſt head has nine feet to move, in the ſame time, inſtead of ſeven with a ſlower motion, which was the caſe when ſhe was loaded with timber, and this I hope will be underſtood to account for the difference, why ſhe is more labourſome when loaded with coals than with timber. And ſuppoſe this ſhip was to be loaded to the ſame draft of water, without any dennage in the bottom with lead, which is eleven times heavier than its bulk of water, which might bring the centre of gravity and motion eighth feet below the water's edge, and within eighth feet of the lower part of the keel, which is leſs than a fifteenth part from the keel to the top-gallant-maſt-head, in ſuch a trim it is well known from experience, that in a ſtorm, the above mentioned cauſes would act with ſo much more power, to give her more quick, violent moving, rolling motion, and for every foot her keel was made to move ſideways, the maſt head would have to move fourteen feet in the ſame time, which would be ſure to make her roll away her maſts, in the firſt place, and after that, become ſo much more labourſome, for want of them, as to be in great danger of foundering, by working looſe the hull.

The conſequence of loading lead without dunnage.

I HOPE what has been ſaid on this important ſubject, makes the principles underſtood, how ſhips act, and how they are acted upon, by thoſe natural cauſes above mentioned, and the neceſſity there is to try every expedient, that may prevent the loſs and damage occaſioned by the ſhips being too crank or too ſtiff; for I am convinced from experience and obſervation, that it is not the ſhape of the ſhip's bottom, that makes her eaſy or uneaſy in her rolling motion, as is commonly believed, but it is the centre of gravity lying higher or lower, according to the breadth and height of the veſſel, the water acts with more or leſs power; and that makes narrow built ſhips fitteſt to carry heavy cargoes, with the leaſt expence of dennage, whereas for light bulky cargoes, broad ſhips will anſwer beſt. The above mentioned ſhip was much eaſier in her rolling motion, when loaded with timber, than with coals, which was a certain ſign that her deck lay too low, for her breadth, to carry that cargo with eaſe in great ſeas; and by account, ſhe was ſtiff enough when quite light, to bear ſail to go any where, and only took in ballaſt, to make her ſail better by the wind, ſo thar it is evident, that this, as well as every other ſhip, has a certain trim, which to them, is the ſafeſt, eaſieſt, and beſt. And when this beſt trim for ſtiffneſs is obſerved, from experience, hints propoſed to try experiments, to get and keep them afterwards

Experiments recommended to keep ſhips in their beſt trim, by their different degrees of ſtiffneſs.

wards as near that trim by ſtowage as circumſtances will permit; by making nice obſervations how much the ſhip is made to heel when hoiſting the long-boat in and out, or in the takles a long ſide, clear of the water, which is ſuppoſed to be ſmooth, and the ſhip quite upright, when the experiment is tried; and the remarks how much the ſhip is made to heel, may be made by various ways, as by water upon deck ſtanding in particular places, or running over from one ſide of the deck to the other, by making marks at the water's edge without board, by meaſuring the different heights of the gunnels, in the broadeſt part from the water's edge, by a plumb-line in the higheſt vacancy within board, from any fixed thing above, and down in a vacant hatchway, or the middle of the after part of the companion, to the cabbin deck, or bulk head of the cabbin, or from the middle of the fore or after part of the mizen-top upon deck, &c. and it would be well to ſet down the remarks in a log book, with the draft of water, and the ſhip's behaviour at ſea each time the experiment is tried, which in time, by taking pains, might become of great ſervice. In the above mentioned ſhip by this practice, would be found a very ſenſible difference, by her heeling more when loaded with timber, than with coal, as above mentioned. In caſe ſhe was to load lead, or iron, a judgment might be formed by this experiment, how the ſtowage would anſwer, ſo that in this, or any other ſhip, where there had been ſufficient experience, by this practice, the ſtowage might be altered as occaſion might require, before ſhe went to ſea. Where ſhips are too ſtiff, or too big for the long boat to be heavy enough for this purpoſe, the long boat might be filled with water, to a certain height, each time: and in ſhips of war, might be added to the weight of the long boat, a certain number of guns, by being run out on one ſide cloſe over to the other; and they might alter her trim as experience might require, by ſtowing the iron or heavy ballaſt, higher or lower, in the main body of the ſhip, &c.

On getting a SHIP under Way.

To ſail with the flood tide, recommended.

IT is ſuppoſed that the ſhip is now ſtowed and trimmed to the beſt advantage and that every thing is ready for ſea. If it be in a tide way, and a leading wind that a ſhip can ſtem the tide, it ſhould be a rule, when the tide ſerves, to get under way and ſail againſt

againſt the flood, which gives time to get in the moorings, or the anchor up, and ſtowed away at pleaſure, and the ſhip may be ſteered without danger in little room through a croud of ſhips, ſhould any be in the way, and through narrow or ſhoally channels with a flowing tide; by which means many dangerous riſks may be avoided.

To heave a peek with the firſt of a windward tide commended.

To prevent the difficulty that often happens in getting the anchor, when it blows freſh with a windward tide, when the tide firſt ſets, or make right to the windward, the cable ſhould be hove in as it ſlacks, till the anchor is apeek, before the ſhip ſwings end on to the tide, to bring the wind aft, that may keep the ſhip a head of the anchor, with the cable ſo tight under the bows and bottom, that it cannot be hove in, without breaking the ſhips ſheer, by putting the helm hard over, firſt one way then the other; this ſlacks the cable, ſo that it may be hove in briſkly, for the time the ſhip ſheers broad ſide to the tide, from one ſide of the anchor to the other, but the ſhip is liable to get ſo much head way in the time of ſheering, as makes her bring up with ſo powerful and ſudden a jerk, that I have had the experience of breaking the cable by this practice in the Downs, which obliged us to ſtay there with a fair wind, to get our anchor again.

On getting under Way with a LEE TIDE.

The method of proceeding to be made known.

WHEN under the neceſſity of getting under way with the wind and tide in the ſame direction, and ſhips or ſhoals lie near right a ſtern, dangerouſly, in the way you are to go; in ſuch a ſituation, or any other that happens to be dangerous, I would recommend, where time would admit of it, to call every capable officer to look about with attention, where the danger lies, to conſider and conſult what is beſt to be done, and what can be expected for the ſhip to do, on the occaſion, and eſpecially if there be but little wind; ſuppoſe it to blow at the rate of ſix miles an hour, which, at an anchor, will ſeem a commanding breeze; but it ſhould be conſidered, that if the tide runs at three miles an hour, when the ſhip is under way ſhe will looſe one half of the wind's power, which may hinder her from performing what may be expected from the moſt dexterous management. And after the opinions are heard, the intended method of proceeding, ſhould be made

To conſult the officers on

neceſſary, occaſions recommended.

made known, that none through ignorance may hinder, but that all may know how to help to put the deſign in practice, whether the ſhip is to be ſhot a-head, or backed a-ſtern of the danger. This might contribute greatly to prevent loſs or damage, frequently cauſed by weighing the anchor, and proceeding without thought of the difficulties that attend getting a ſhip ſafely under way, in narrow or crowded places. Making a ſtern board is frequently neceſſary, and the beſt management depends greatly on the ordering of the helm, the effects of which, on theſe occaſions, I ſhall endeavour to explain.

ON THE HELM.

WHAT we call the helm is the tiller, that turns the rudder on each ſide of the afterpart of the keel and ſternpoſt, for the water to act upon, as the management of the ſhip may require; and as ſhips differ in breadth abaft, ſo ſhould the tiller in its length; that is, the tiller ſhould be juſt long enough to reach cloſe over to each ſide, when the rudder ſtands at an angle of thirty three degrees, or bears three points of the compaſs from the direction of the keel, which is generally allowed to anſwer beſt, as I have before obſerved and proved by experiment, page 48, where I have already noticed the abſurdity and uſeleſſneſs of putting the helm too far over, and that the rudder ought not to traverſe to leſs than thirty three degrees, though in many it was found not to traverſe more than thirty, and even twenty eight degrees,) that none of its utmoſt power might be loſt, becauſe it is often wanted on the moſt important occaſions, when ſafety may depend upon it.

MOVING the helm can have no effect to manage a ſhip but when ſhe paſſes, through the water, or the water paſſes by her, in a tide or currents way, and then the water, gives equal power to the helm, as if the ſhip went at that rate through the water.

The effect of the water upon the rudder.

WHEN the helm is amidſhips, the rudder can have no effect to turn the ſhip either way, as it then ſtands in the ſame direction with the keel and ſternpoſt: but ſuppoſe the helm put to ſtarboard, it turns the rudder towards the laboard ſide of the ſhip, which makes the laboard ſide of the rudder to reſiſt the water, which acts with a power according to its velocity, or the ſhip's head

headway through the water, againſt the laboard ſide of the rudder, to turn the ſhip's ſtern to ſtarboard, and conſequently her head to port, and the centre of this turning motion is allowed to be at the ſhip's centre of gravity, as mentioned page 18. It may eaſily be perceived, when the helm is put hard a port, how it acts from the ſame cauſes to turn the ſhip's head to ſtarboard, as may be ſeen by looking at plate 7th, where the plane of a ſhip, in three different ſituations is repreſented with the helm hard a port, which makes it evident that when the ſhip has headway the water muſt act againſt the ſtarboard ſide of the rudder, in a direction, ſo as to turn the ſhip's ſtern to port, or towards that ſide the helm, or tiller is put upon, and her head to ſtarboard from that ſide that the helm lies, as above mentioned.

On the Helm when a Ship has Sternway.

THIS deſerves particular notice, the moſt maſterly management depending upon it, on very important occaſions, as will appear hereafter.

WHEN a ſhip gets ſternway through the water, the helm has juſt the contrary effect upon the ſhip, to what it has when ſhe has headway; as may be perceived by the above mentioned figures, plate the 7th, figure 2, with the helm hard a port, when the ſhip gets ſternway, the laboard ſide of the rudder, in that direction, is the firſt part of the ſhip that the water acts againſt, and it cauſes ſuch a reſiſtance, as to have a powerful and ready effect to turn the ſhip's ſtern to ſtarboard from that ſide the tiller lies, and her head to port, that is always towards that ſide the tiller is put upon, whether to ſtarboard or port, which ſhould be ſtrictly attended to on all occaſions, when a ſhip is about getting, or has got, ſternway through the water.

To caſt a Ship upon the Larboard Tack, and back her a ſtern of Danger, as above mentioned.

SUPPOSE a ſhip at a ſingle anchor, ſituated as mentioned in page 72, the wind and tide being both in the ſame direction, and ſhips or ſhoals lying near right a ſtern, in the way you muſt go, and to keep clear of them, it requires to caſt the ſhip upon the larboard tack, and make a ſtern board. (In all theſe proceedings I ſpeak of a three maſt ſhip, and the main braces leading aft.)

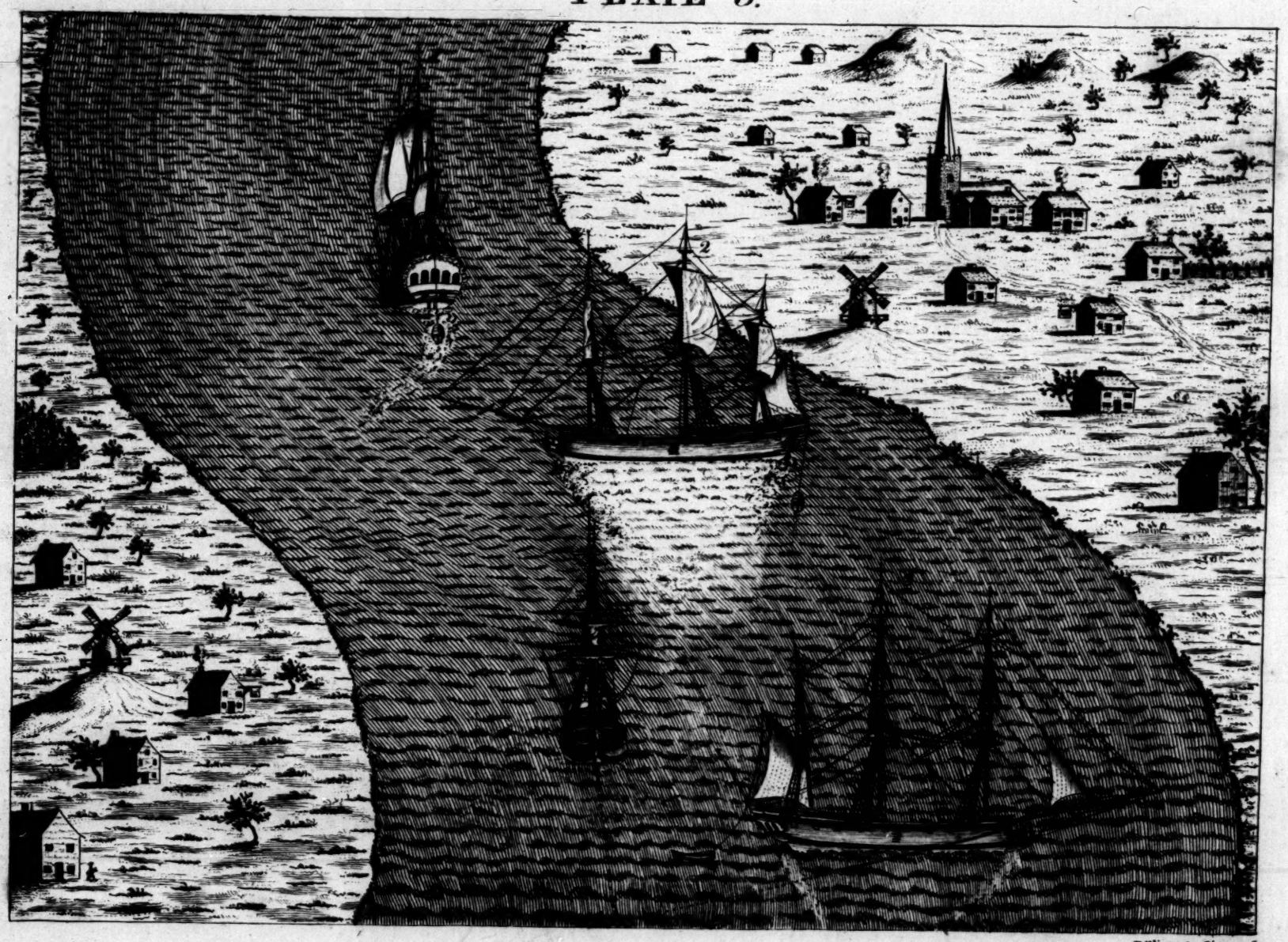
IN trading ſhips, it requires all hands to heave up the anchor, therefore all the neceſſary ſails ſhould be made as ready as poſſible, the three topſails hoiſted, and the yard braced ſharp up, with the larboard braces, and the mizen hauled out, before weighing.

IN this ſituation, you have only to attend the helm, and put it a port, when the anchor weighs; the tide running aft, acts againſt the ſtarboard ſide of the rudder, and in that direction, will caſt the ſhip the right way; and bring the wind upon the larboard bow, which may be kept ſo, at pleaſure, by the helm, till the ſhip begins to get ſternway through the water, which ſhould be ſtrictly noticed, to put the helm hard a port, or a weather; which puts the plane of the ſhip in a poſition, as repreſented plate the 7th, figure three, and ſuppoſe, the wind on the larboard bow, with the topſails aback, which will ſoon give the ſhip ſternway through the water, and will act againſt the larboard ſide of the rudder in that direction, and will have great power to prevent the ſhip from falling too faſt off from the wind, and by the anchor under the bow, while it is heaving up, and the foretopſail kept ſhivering, ſhe will drive, as the ſhip is repreſented plate the 3d, figure 2, by which means it may be ſuppoſed that ſhe has drove paſt, and kept clear of the danger, or of the ſhip, figure 4, and has got the anchor up, and room to ware, and get before the wind, as repreſented figure 1, in the ſame plate.

The advantage of making a ſtern-board.

THUS making a ſtern board, gives an advantage in getting underway, as above, from a ſingle anchor; as the anchor heaves up eaſier when the ſhip goes a ſtern, and at the ſame time it is heaving up, it helps to keep the ſhip's head to the wind, which will continue the ſternway the longer; but notwithſtanding, all theſe helps, it is well known from experience, that a ſhip cannot be ſteered long, ſtern foremoſt, under ſail, ſo as to keep the wind before the beam, and then the ſternway, the power of the weather helm, and her falling off will all ceaſe at the ſame time: and the ſhip will drive broad ſide through the water for a little time, as repreſented

PLATE 3.



Billinge Sc. Liverpool.

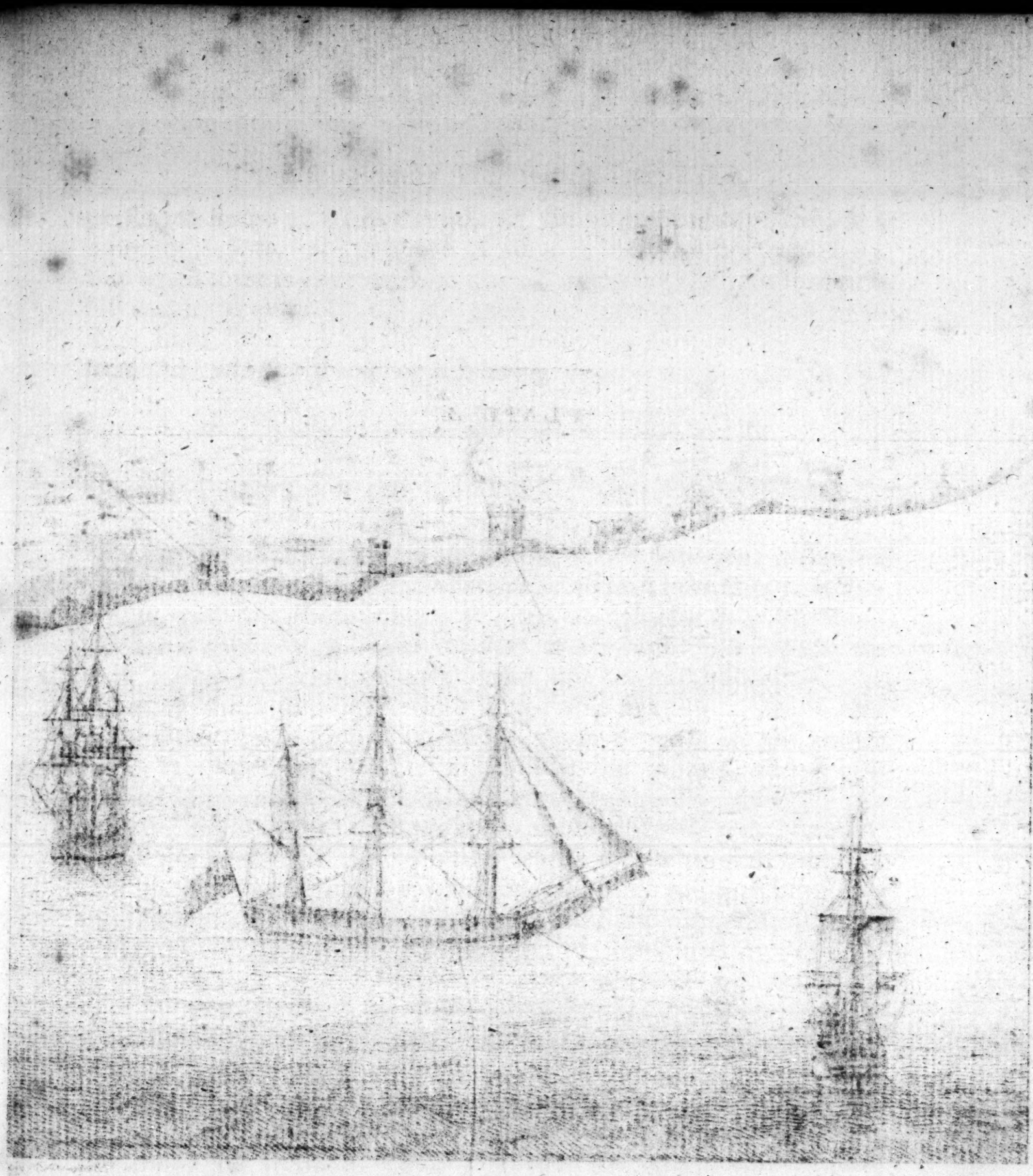
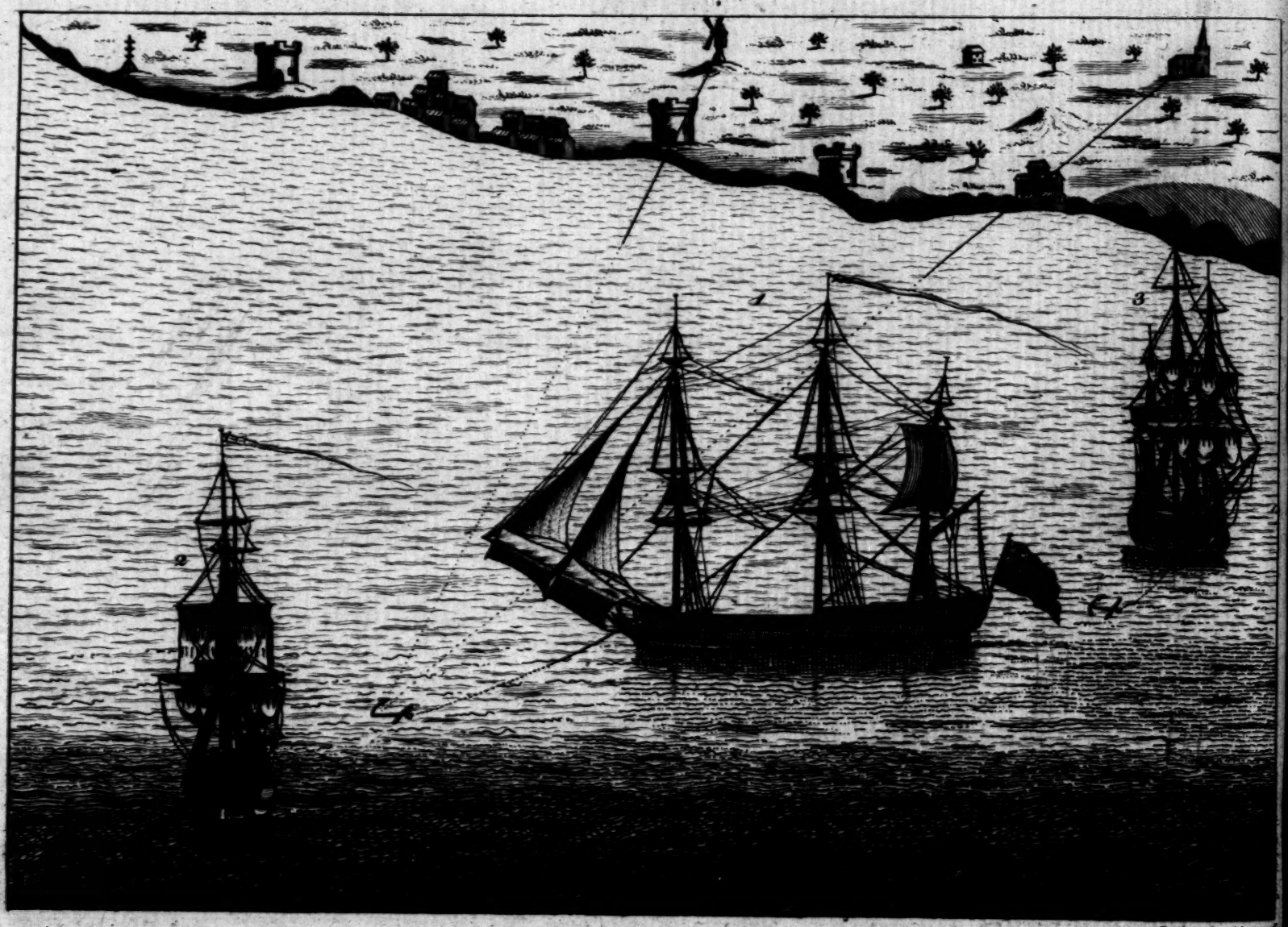


PLATE 5th.



Billinge Sc. Liverpool.

Fig 1

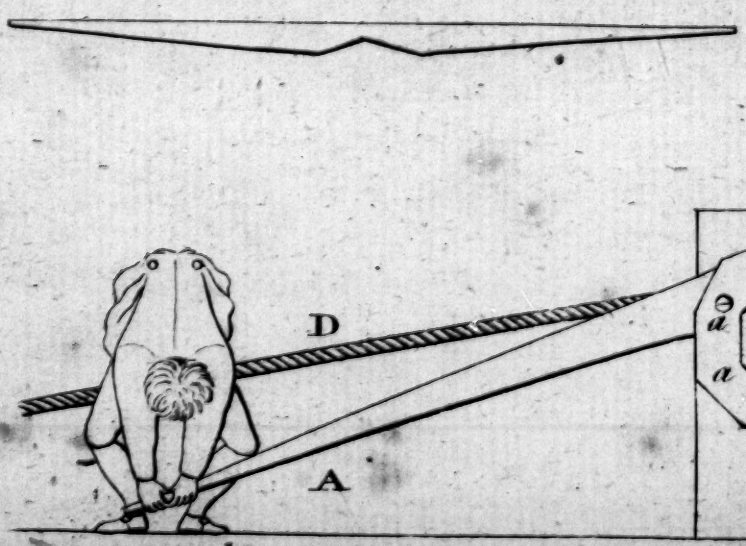


Fig 3

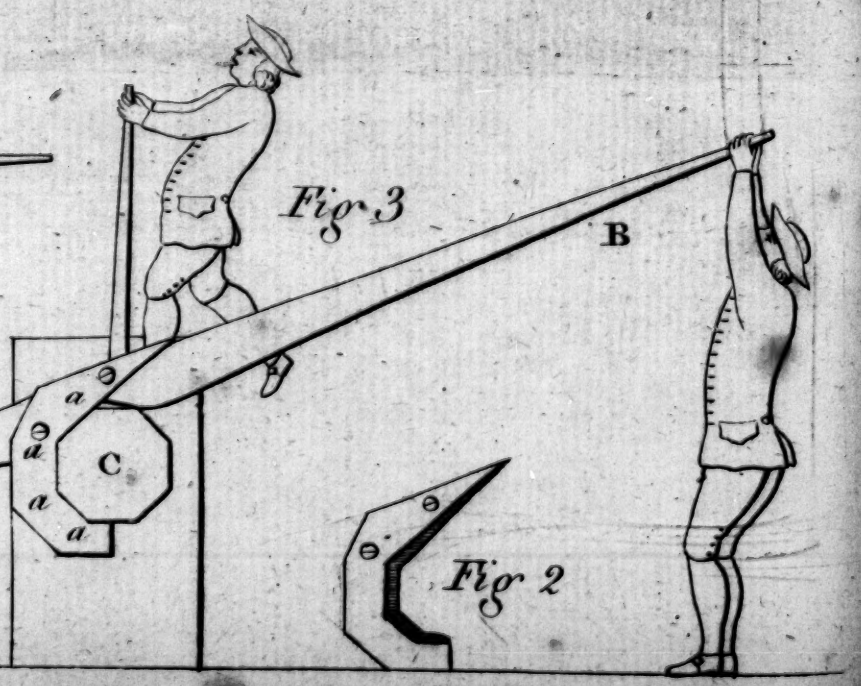


Fig 2

preſented figure 2, plate the 3d, till ſhe gets headway; which is a proper time to ware, as above mentioned, if the anchor is cloſe up; but when there is little room to ware, I would not wiſh to attempt it, (if it can be avoided) till the anchor is hove quite up, for many ſhips have been run on ſhore, in attempting to ware, by ſtreſs of head ſail, whilſt the anchor is heaving up.

To caſt a Ship upon the Larboard Tack, and ſhoot her by the Wind a head of Danger.

BUT let us ſuppoſe that from the above ſituation, inſtead of backing aſtern to clear a danger, it requires the ſhip to be ſhot a head, and that there is but juſt room enough, cloſe by the wind, to clear a danger that lies in the way to leeward. As ſuppoſe the ſhip, figure 2, plate the 5th, could not be got underway with ſafety, without ſhooting a head of the ſhip figure 1. To proceed with ſafety from ſuch a ſituation, much depends on the anchor being hove briſkly up, after it is out of the ground, and having proper ſails ready to ſet to the beſt advantage. The three topſails muſt be hoiſted and the yards ſharp braced up with the larboard braces forward, and the ſtarboard braces aft, when the anchor is at a long peek, ſo that at weighing the anchor, you may have only the helm to attend: putting it hard a port, the tide will act upon the rudder, and the foretopſail being braced ſharp up with the larboard braces, will readily caſt or box the ſhip off, the right way, ſo as to fill the after ſails, when the foretopſail may ſoon be braced about, and fill'd, before ſhe gets ſternway, and the helm may keep the ſhip under command, to ſteer her by the wind a head, clear of danger. But if the ſhip gets ſternway in caſting, the helm ſhould be kept hard aweather, to prevent her from falling too much off from the wind, and when ſhe gets headway again, you ſhould be very cautious how you eaſe the weather helm, with the anchor, much below the bows, which increaſes the reſiſtance forward, and may bring the ſhip up in the wind, ſo as to prevent her ſhooting clear of the danger, which ſhould be guarded againſt by the weather helm, and head ſails, as jib and fore-top-maſt ſtay-ſail, &c. As ſoon as the ſhip is ſhot far enough a head, to clear the danger, to lee ward, and there is but little room, a head, it is certainly beſt to bring the ſhip to, and drive with the helm a-lee, with the main and mizen topſails aback, and the foretopſail

In caſe of getting ſternway.

ſhivering, as repreſented plate the 3d, figure 2, till the anchor is up; then take proper time to ware, as before recommended.

To caſt a SHIP on the Larboard Tack, when riding in a Tide, with the Wind two Points on the Starboard bow.

SUPPOSE a ſhip riding in ſmooth water in the ſtream of a tide, with the wind two points on the ſtarboard bow, and ſo near the ſhore on the larboard ſide, that ſhe muſt be caſt upon the larboard tack to clear the ſhore. I have caſt a ſhip on the larboard tack from the above ſituation, by the common method of proceeding, as mentioned in the laſt caſe, having the three topſails hoiſted, and the yards ſharp braced up, with the ſtarboard braces aft, and the larboard braces forward, with the ſtarboard fore-top-bowling well hauled, and at the anchors weighing, putting the helm hard a port; the tide acting upon the rudder, and the wind upon the ſails braced in that direction, brought the ſhip about, with the wind on the larboard bow, before ſhe got ſternway, which ſhould be always ſtrictly noticed, for in all proceedings of this kind, if a ſhip gets ſternway, before ſhe brings the wind right a head, you may be ſure that ſhe will not come about the right way. In that caſe it muſt be the ſureſt way, directly to veer away cable, and bring the ſhip up again, and carry out a ſmall anchor, on the larboard bow, taking in the rope, and hauling it tight, on the larboard quarter; when the bower anchor is apeek: or you muſt lie till the windward tide makes, to bring the wind on the larboard bow, when you may get underway, and clear the ſhore.

To caſt by a ſmall anchor.

To caſt a SHIP on the Larboard Tack, when riding with the Wind right a head, and to ware her ſhort round, before the Wind in little Room.

IN this caſe, the head ſails only ſhould be looſe, viz. the fore-top-ſails hoiſted, the foreſail in the brails, braced ſharp up with the larboard braces, the jib and fore-top-maſt-ſtay-ſail ſet with the larboard ſheets flat aft, when the anchor is apeek, and if there is a lee tide running, at weighing the anchor, the helm ſhould

ſhould be put a port, ſo far as to bring the wind a little on the larboard bow, which ſhould be kept ſo, by ſteering the ſhip till the tide ceaſes to run aft, which ſhould be ſtrictly noticed by the water along ſide, then put the helm hard a ſtarboard, or a lee, and when the ſhip gets ſternway, the water will act very powerfully on the ſtarboard or lee ſide of the rudder, in that direction to turn the ſhip's ſtern to windward, whilſt the wind acting at the ſame time upon the headſails, aback, will box her round off, upon her heel, ſo as to bring the wind almoſt aft, by the time ſhe loſes her ſternway; then the ſhip will ceaſe falling off, and ſoon get headway; which ſhould be attended to, and the headſails be braced about flat, with the ſtarboard braces, and the helm ſhifted hard a port at the ſame time. Caſting with a-lee tide.

WHEN there is no tide, but the water ſtill at weighing the anchor, the helm muſt be hard a ſtarboard, and as the ſhip gets ſternway, the water meets with ſo much reſiſtance againſt the ſtarboard ſide of the rudder in that direction, that the rudder acts with great power to turn the ſhip's ſtern round to port, and the headſails being ſet and trimmed as above mentioned, and the foreſails let fall with the ſtarboard bowline hauled cloſe forward, will contribute to caſt the ſhip the right way round ſo far, by the time ſhe loſes her ſternway, as that you may then proceed as above directed, and may get the ſhip under command of the helm to ſteer at pleaſure, as ſhe gets headway. The ſucceſs of this caſe depends greatly on heaving up the anchor briſkly. From the above it will be eaſy to know how to caſt and get a ſhip under way upon the ſtarboard tack; the ſame rules hold good, only to manage the helm and ſails the contrary way to that which has been deſcribed. Caſting in ſtill water.

ON TURNING TO WINDWARD.

IT may not be amiſs here, to endeavour to explain by what means, and upon what principles it is, that this moſt noble and uſeful machine, a ſhip, is made to gain ground, and is brought about from one tack to the other, againſt the wind and waves, when they are moderate.

IT is well known that we have ſhips that will ſail from ſix to nine miles an hour, upon a wind, when it blows freſh, and the water is ſmooth, and will make their way good within ſix points of the

the wind, ſo as to gain to windward, in ſtill water, a third of what they run by the log; ſuppoſe ſix miles an hour to gain two miles, or nine miles to gain three to windward, with the ſails trimmed in that oblique or ſlanting direction as is particularly deſcribed page 52, which certainly tends to force the ſhip much more broadſide to leeward, than a head. For it is a known principle, that a ſhip ſailing with the wind upon the beam, and the plane of the ſails trimmed to four points, or forty five degrees from the direction of the keel, the ſails at that angle tend equally to drive the ſhip broad-ſide to leeward as a head; ſo that a ſhip's ſailing and turning to windward as above mentioned, muſt be owing to the ſhape of the ſhip's hull, which makes little reſiſtance on ſailing a head, compared with the great reſiſtance made by the broadſide in the water, not only by the ſhip's extraordinary length in proportion to her breadth as has been obſerved, but all thoſe thin parts, the dead wood, cutwater, gripe, ſtem, keel, ſternpoſt, and rudder, which make very little reſiſtance in the ſhip's going a head, but a powerful reſiſtance ſideways; ſo that though the ſails are trimmed in that ſharp direction, yet in a moderate wind when the ſhip can carry all her ſails, by the wind and the water ſmooth, ſhe will ſail with the wind two points before the beam, as faſt, and faſter than ſhe will right before the wind, with the ſame breeze. Thus ſuppoſe the wind blows at the rate of ten miles an hour, when a middling ſtiff, faſt ſailing ſhip may carry her top-gallant-ſails in ſmooth water, and ſail at the rate of ſix miles an hour, and gain two points to windward, which increaſes the power of the wind one ſixth part, and makes it act equal to twelve miles upon the ſails cloſe by the wind, and if you put right before the wind ſo that we will ſuppoſe the ſhip to go about five miles an hour, this reduces the power of the wind one half, and it has not one half of the canvas to act upon that it has when the ſhip is ſailing cloſe by the wind. To confirm this opinion, I have tried experiments, and found the velocity of the wind in a pleaſant breeze, by a man running on the ſhore right before the wind, ſo as to keep a light vane in his hand becalmed, when he run with a log-line faſtened to him, five different times, to be about nine knots; I then tried a ſchooner rigg'd boat with two ſails cloſe by the wind, and found that ſhe ſailed, by the ſame log-line, five knots, at five points from the wind; then I put her right before the wind, and tried her with both ſails drawn full, when ſhe went but the ſame five knots by the log in three different trials, before

What makes a ſhip gain to windward.

before and by the wind, at the rate of five miles an hour, when the wind blew at the rate of nine miles an hour; I reckon that a faſt ſailing ſhip would have gone as faſt or faſter than this boat, at ſix points from the wind, with her principal ſails braced up to three points of the wind, as before obſerved, which is ſharp and near enough to the wind, for a three maſt ſhip, that has more top-hamper to hold wind than a ſloop, or a ſchooner rigged veſſel, and therefore repuires to ſail farther from the wind, to overcome all the reſiſtance that is againſt her: and a ſhip makes more or leſs lee-way in proportion to her headway, on which depends the power of the helm, to ſteer and bring her about from one tack to the other, in the moſt advantageous manner, ſo as to gain ground to windward. I have, in chaſing to windward, been coming faſt up with many a veſſel that ſailed much nearer the wind than ours; for it ſhould be conſidered that a ſhip ſailing at ſix points from the wind, nothing but the ſails properly trimmed contributes to give her headway, and all other parts of the ſhip or her materials, that the wind and waves act upon, tend (two points out of eight) to give her ſternway, and the wind may be ſaid to be reflected, ſo as to act upon the after part of the ſhip, as if it was only three points from being a head, as may be perceived by the fly of the enſign, and the after ſails upon the mizen-maſt ſtanding at an angle of only a point and a half from the direction of the keel, as mentioned page 53. Therefore to trim a ſhip's ſails to ſteer nearer the wind than ſix points, muſt tend to leſſen her headway, and in proportion increaſe the lee-way, ſo that there muſt be more loſt than gained by this practice, except in a very narrow river, where it may prove ſometimes neceſſary.

An experiment to prove that when the wind blew nine knots, a boat ſailed five by and lavge.

To ſail within ſix points of the wind is near enough for a three maſt ſhip.

ON TACKING AND TURNING TO WINDWARD.

THIS excellent property of a ſhip turning to windward, and tacking or ſtaying well, depends greatly on her dimenſions, the ſhape of her bottom, and her being trimmed; and I reckon a ſhip is in the beſt trim for tacking, as well as ſailing, both by the wind and large, and is the moſt manageable on all occaſions when ſhe will almoſt ſteer herſelf cloſe by the wind, under all her principal ſails, carrying the helm near a midſhips with a trembling motion. This a faſt ſailing ſhip will often do, when it blows freſh

On a ſhips beſt trim for ſailing.

freſh and the water ſmooth, though two thirds of the canvas (as I have counted) ſtand before the mainmaſt, and a good deal of it over the bows, upon the bowſprit and jib boom, when there is none which projects over the ſtern, except part of the long boom mizen, which has lately become the practice, and which I look upon as an improvement. When a ſhip carries the helm a lee at ſuch times, it is a ſign that ſhe is too much by the ſtern, or the maſts are ſtayed or ſtand too far forward. But when a ſhip is not enough by the ſtern, or the maſts rake or ſtand too far aft, ſhe will gripe, and carry the helm a weather, which is thought by many to be an advantage in turning to windward. This opinion I have heard refuted by a very plauſible experiment, tried on this account, by fixing a rudder to the ſtem of a ſailing boat, ſo that it could be pointed to windward occaſionally on either tack, thinking this would make the boat carry her proper helm a weather, and the water would act upon the lee ſide of the two rudders, in a direction ſo as to cauſe her to gain more ground in turning to windward: but it was found from experience to increaſe the reſiſtance a head, and that it did more harm than good. I have experienced great advantage from ſuiting a ſhip with more head ſail than after ſail, to eaſe the weather helm, when chaſed by a much ſuperior force at a ſmall diſtance to leeward, carrying a preſſing ſail cloſe by the wind. At ſuch times it may be perceived how much the water is raiſed above its natural level before and on the lee bow, and you may ſee a hollow, below the level on the luff of the weather bow, by the headway; and the ſhip heeling to the preſſure of the ſail ſhe makes a fuller water line to leeward, than to windward, conſequently a greater reſiſtance on the lee than the weather bow, which is the reaſon that ſhips in general require ſo much more head than after ſail, and to ſwim ſo much by the ſtern to be in the beſt trim to ſteer, and be under command of the helm ſo as to make them moſt manageable.

An experiment of a rudder fixed to the ſtem of a ſailing boat.

SHIPS lightly ballaſted, or an extraordinary length, are very uncertain, and require extraordinary attendance and time in tacking, (as is mentioned page 24,) whilſt a ſhorter well proportioned ſhip in a good trim for turning to windward, may come about ſo faſt as to make it difficult to work and manage the ſails, ſo as to get them properly trimmed in due time.

To tack a Ship when in a dangerous Situation by a rough Sea, or when her Trim, or her Property, is ſuch as may make her Staying doubtful.

SUCH circumſtances certainly deſerve attention, as ſafety may depend upon management; every thing ſhould be ready and clear, the people properly ſtationed, the ſails fairly trimmed, the ſhip cunned and ſteered juſt full and cloſe by the wind, and if it is a rough ſea take the advantage of the firſt ſmootheſt time, when the ſhip has as much headway upon her as can be expected. To haul down the jibb, if ſet at ſuch times is of great ſervice, and not to put the helm a lee all at once, but luff the ſhip up by degrees to ſhake the ſails; and not till then, order the helm hard a lee with a loud voice, to let go the lee ſheets forward, but not the lee braces and fore top-bowline, as in common, to back the head ſails too ſoon; that ſtops the ſhip's headway, which muſt continue to give power to the helm till the wind is brought a head, elſe you may be ſure the ſhip will not ſtay. To off tacks and ſheets, and haul mainſail when the wind is a point on the weather bow, this ſwings the yards ſharp round, that the main tack may be got cloſe down, whilſt the head ſails becalm the fore leech of the main and main-top-ſails, at the ſame time the wind blowing aſlant on the after leech of theſe ſails, acts jointly with the rudder to turn the ſhip's ſtern, ſo as to bring her about the right way, as repreſented by figure 1, plate the 2d.

WHEN a ſhip comes about, at ſuch times ſhe is ſure to have ſternway, by the time the head ſails are hauled; therefore the helm ſhould not then be ſhifted a lee, as is commonly done, but ſhould be kept hard a-weather till her ſternway ceaſes: the water acting upon the weather ſide of the rudder prevents the ſhip falling round off from the wind, which the helm when hard a lee occaſions while the ſternway continues; and ſtrict notice ſhould be made by ſome object a head, or by the compaſs, that the ſhip continues coming about till the wind is on the other bow, for if ſhe ſtops with the wind a head, and by the water along ſide her headway is perceived to be done, the helm ſhould be directly ſhifted to the other ſide, ſo that by the ſternway the water may act upon the rudder and bring her about the right way, and then the helm ſhould not be kept a lee, but immediately ſhifted, and kept hard a weather till her ſternway ceaſes. For the reaſon already given,

the head ſails may be hauled as ſoon as poſſible, for the ſhip will be ſure to fall off the faſter, and farther in proportion to her ſternway, ſo that the weather braces ſhould be tended to prevent the head yards flying fore and aft, as they will do if it blows freſh, and to keep the head ſails ſhivering, that the fore tack may be got eaſily cloſe down, the ſhip ſtopt the ſooner from falling off, and ſhifting the helm a lee when the ſternway ceaſes, the head ſails may be trimmed ſharp as the ſhip is perceived to come to.

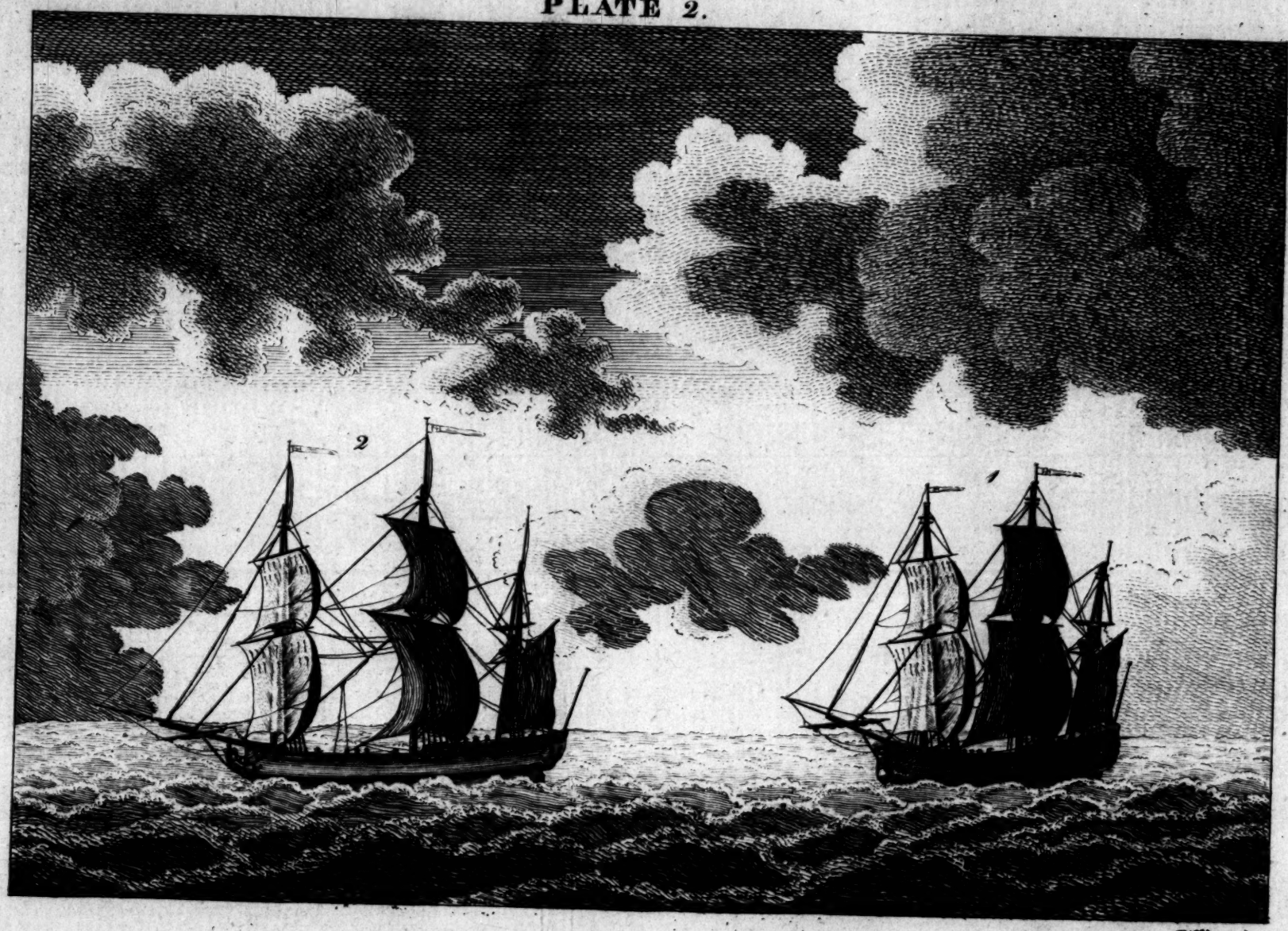
To tack a quick-turning SHIP in a freſh Gale, and ſmooth Water.

A GOOD or bad haul in this caſe makes a material difference in gaining to windward, and in wear and tear, and in the eaſe of the people. I have been in a ſhip, where when hauling mainſail, it was always catched a back, as is repreſented figure 2, plate 2d. ſo that we had the maintack to get down five or ſix feet, and the after ſails to trim after the ſhip was tacked; and that this is often the caſe, may be ſeen from the common print of a ſhip tacking, where it is repreſented in the ſame manner. This is owing to the cuſtom of always putting the helm hard a lee whether the ſhip requires it ſo far or no, and not hauling the mainſail till the wind is right a head.

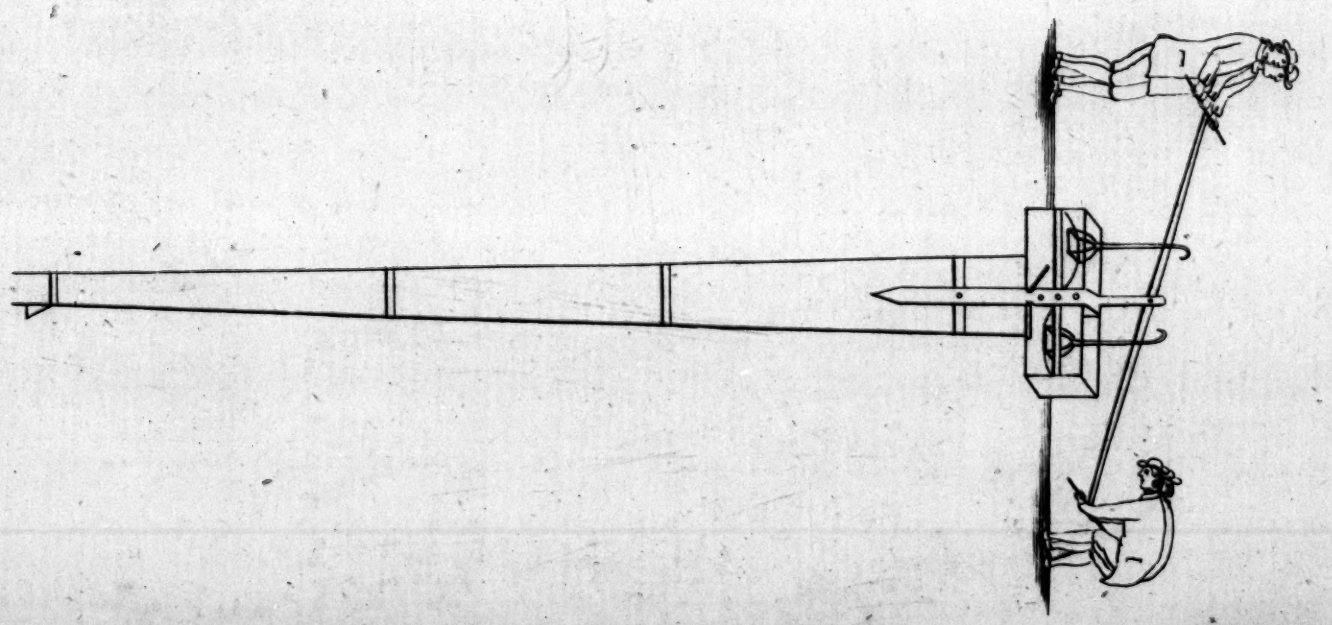
THEREFORE to make a good haul at the time, when it is known that the ſhip will be very quick in ſtays, the helm ſhould not be put hard a lee, as cuſtomary, but half down a lee, leſs or more, as experience proves to be ſufficient to bring her about before ſhe loſes her headway, to off tacks and ſheets as ſoon as the ſails ſhake that the mainſail may be hauled, with the wind two points on the weather bow, as repreſented figure 1, plate the 2d. This management helps the ſhip in ſtays, and gives time and a favourable opportunity to get the main tack cloſe on board, and the after ſails fairly trimmed by the time they fill, ſo that the people may be all at liberty to haul and trim the head ſails; then the helm ſhould be ſhifted, or righted only, as the ſhip may require, by her head or ſternway, to work her cloſe, and not always hard a lee, as cuſtomary; for if the ſhip has headway, it may bring her up in the wind; and if ſternway, it may make her fall broad off from the wind, as before mentioned.

IT muſt be allowed, that the leſs helm a ſhip is tacked with, ſo as ſhe does not get ſternway, the farther ſhe will ſhoot and gain to windward

PLATE 2.



Billinge. Sc.



windward in ſtays, for the rudder ſtops the ſhip's way through the water more or leſs, in proportion as the helm is put over to either ſide, as appears from the experiments I related page 47. And as to a ſhip coming about with little helm, it is well known that will often happen when not intended, by a ſmall neglect of the helm.

Tacking in very narrow channels.

IN narrow channels, where a ſhip has very little room to turn to windward, ſhe may require the helm to be put down hard a lee, all at once; and the lee braces forward, ſheets and fore-top-bowline, all to be let go at the ſame time, alſo to brace the head-ſails, which may prevent the ſhip ſhooting a ſhore in ſtays. When this happens the mainſail may be hauled with the wind three points on the weather bow, when the after ſails ſhake, and the headſails take aback, by being braced to, which will give more time to get down the maintack, and to trim the afterſails without hindering, but rather helping, the ſhip's ſtay, as before obſerved. For ſuppoſe a ſhip was to be launched head foremaſt, with her ſquareſails ſet and trimmed ſharp, with the larboard braces forward, and the ſtarboard braces aft, and with the wind three points on the ſtarboard bow, as repreſented figure 1, plate 2d. it is evident from thence that the wind would act whilſt the headway continued, ſo as to turn the ſhip's head to ſtarboard; and on the afterſails to turn the ſtern to port, which would bring her round on the larboard tack, though ſhe had no rudder hung, or if ſhe had her helm a midſhips, by the effect of the ſails only.

On working to windward in the coal trade to London.

BUT the beſt leſſons for tacking, and working to windward in little room, are in the Colliers bound to London, where many great ſhips are conſtantly employed, and where wages are paid by the voyage, ſo that intereſt makes them dexterous, and induſtrious to manage their ſhips with few men, in a complete manner, in narrow channels, more ſo than perhaps in any other trade by ſea in the world. The ſeamen there go regularly from one thing to another, which they know depends upon them, by the great practice they have in turning to windward againſt weſterly winds, through narrow and ſhoal channels, with their deep loaded ſhips, which are trimmed near an even keel to make them draw as little water as poſſible, and their main-maſts ſtand farther aft than common; this occaſions them to gripe, which often obliges them to work the ſpritſail and all the headſails they can bear, to make them manageable when turning to windward. In narrow channels, when it blows ſo ſtrong that all hands cannot haul aft the fore ſheet, but are obliged to heave it aft by the capſtern, even then it

would be looked upon as a great blunder to make a bad haul, obſerving always the ſhip's quick or ſlow motion in ſtays, to off tacks and ſheets, ſo as to be all ready, and haul mainſail in the proper time, whilſt the wind takes the back of the weather or fore leech of the main and main-top-ſail, which ſwings them ſharp round, with the main ſheet block cloſe aft, and the main tack on the other ſide, cloſe forward to the cheſtree or the tack hole, ſo that they have only to haul in the ſlack of the maintack and ſheet, and trim the after-ſails whilſt becalmed by the head-ſails, ſo that all hands are at liberty to help to haul and trim the head-ſails, when the weather requires it.

IT muſt be allowed, as mentioned page 52, that theſe ſhips being adapted for this trade, are rigged as light as poſſible, to make them work eaſy to windward in narrow channels, with few hands; they have no lifts to the lower yards, no fore-top-bowlines; and have ſhort main-bowlines, and ſnatch blocks for the main and fore-ſheets: the main braces lead forward, ſo that the main and main-top-bowlines are hauled and belayed to the ſame pin, the ſame way with the main brace, ſo that one man eaſily lets them all go together at once when the mainſail is hauled, or rather ſwung ſo ſharp round, by the wind, as above mentioned, with ſo ſwift a motion that though they haul every thing hand over hand, they can only get in the ſlack of the main-top-bowline by its going ſingle, which they make faſt to keep the ſails thus ſwung ſharp round, till the main tack is got down, and the yards braced up, they then haul the bowlines upon the main brace, for the reaſons given, and the ſhips being trimmed near an even keel, with the main-maſt ſtanding far aft, as before remarked, makes them work cloſe, by preventing them falling much off from the wind, though they may have loſt their headway, when the head-ſails are hauled: And they are moſtly built with pink ſterns, rounding inwards in their upper works, ſo that they trim the ſails to ſtand full within five and a half points of the wind, and have ſo little top-hamper above water, to hold wind, in proportion to other ſhips, that when turning to windward in narrow channels, they beat ſhips that would beat them in the open ſea, which muſt be owing to ſuch reaſons as have been given: and in order that the running ropes may run clear in making ſhort trips, they dont coil them up, but they let them run as they were hauled.

SAFETY

SAFETY depends greatly on getting a ſhip at firſt fairly underway, and where there is water enough, it is certainly beſt to heave ſhort upon the anchor, and weigh with the firſt of the tide's making to windward. And if the wind is partly acroſs the tide, it will caſt the ſhip with her head towards the weather ſhore, which ſhe may be kept clear of, by driving with the ſails aback, as repreſented plate the 3d, figure 2d. till the anchor is up and ſtowed. And as the tack towards the weather ſhore is the ſhorteſt, it is prudent to back as near the lee ſide as you can with ſafety, to make the firſt board the longer, to get the proper ſails fairly ſet, and to get all ready in time for tacking, and to make as bold as poſſible with the weather ſhore, on which ſide a ſhip is always ſureſt in coming about, and in caſe of miſſing ſtays, a ſhip may be backed off from the weather ſhore, as above mentioned, till ſhe has room to fill and ſet the ſails, and get all her headway to try her in ſtays again, without any danger. But when the ſhip is got about to ſtand towards the lee ſhore, where ſhe is not ſure in ſtays; when going ſlanting with the tide, as going acroſs it, and eſpecially if there run any waves that may hinder the ſhip ſtaying, and not being ſure of all the ropes running clear upon this tack for the firſt time, it may be neceſſary to put the ſhip in ſtays in good time, that, in caſe of a miſs, there may be room enough to fill and try her the ſecond time, or to uſe ſuch means as may prevent her going on ſhore.

BUT when the wind is right againſt the tide, which begins to make to windward, it requires caution, not to weigh the anchor till the ſhip ſwings end on to the tide, and brings the wind ſo far aft, that ſhe may be ſteered right againſt the tide, till the anchor is up and ſtowed, and the ſails with which the ſhip is to work are all ready; as repreſented figure 1, plate the 3d. And to haul the wind from being cloſe over to one ſide, which gives the whole breadth of the channel, to get the ſhip fairly underway, cloſe by the wind, and ready for tacking, let the firſt trip be made as ſhort as poſſible, till it is found how the ſhip and people work upon both tacks, and make them longer or ſhorter boards accordingly afterwards; but care ſhould be taken not to ſtand into an eddy tide on either ſide, which may be perceived by a rippling, which has often occaſioned ſhips to miſs ſtays and go on ſhore.

THERE is a ſaying amongſt ſeamen, if a ſhip will not ſtay, you muſt ware her; and if ſhe will not ware, you muſt box-haul her; and if you cannot box-haul her, you muſt club-haul her; that

that is, let go the anchor to get her about on the other tack; each of theſe maſterly performances deſerves particular notice.

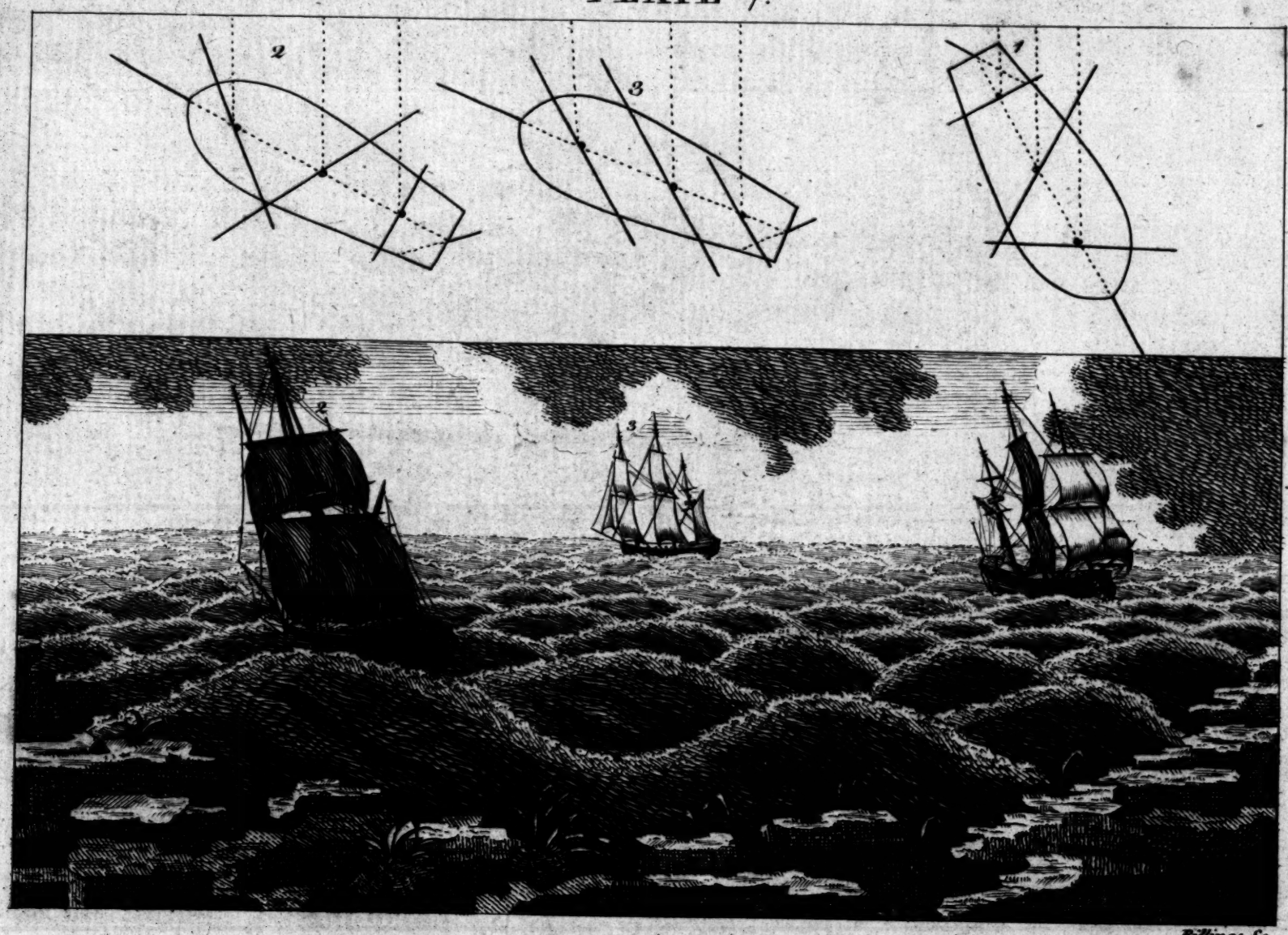
ON BOX-HAULING A SHIP.

MANY advantages as well as ſafety, often depend upon this being put properly in practice; for it often happens, that a ſhip refuſes ſtays, when there is not room to ware in time, ſo as to avoid danger, by the common method of filling the head, and ſhivering the after ſails, &c. Therefore whenever a ſhip in a dangerous ſituation is put in ſtays, and it is perceived that ſhe ſtops coming to, before ſhe brings the wind a head, it is then certain, that ſhe will not ſtay, therefore ſhe ſhould be immediately box-hauled, by keeping the helm hard a lee, and haul off all; bracing about the head as well as the after ſails, hauling cloſe forward the lee fore and fore-top-bowlines, and up mizen, and down after ſtay-ſails at the ſame time; the wind will then act upon the ſails thus aback, and the water upon the lee ſide of the rudder, by her ſternway, will box the ſhip ſhort round, upon her keel, with her ſtern up to the wind, far enough aft for the after ſails to draw full the right way to act with the helm, which muſt be ſhifted hard a weather, when the ſternway ceaſes; ſo that the headway with the wind ſo far aft, will readily bring the ſhip round on the other tack. The main and fore tacks are eaſily got down when the wind is upon the quarter, and ſhivers the ſails, the main ſheet is eaſily hauled aft, and the after ſails braced up and trimmed ſharp, as the ſhip brings the wind more aft, which helps her round the faſter, till the wind comes on the other quarter, that the mizen and mizen-ſtay-ſail may be ſet to take the right way, to bring her to the wind, whilſt you tend and trim the headſails, as ſhe comes to.

Why a ſhip loſes little ground in box-hauling

BOX-HAULING may be proved to be the ſureſt and readieſt method to get a ſhip under command of the helm and ſails, to anſwer many occaſions in little room, as well as ware, and bring her from one tack to the other, with the leaſt loſs of ground, to leeward, when a ſhip refuſes ſtays. Nice managers of ſloop rigged veſſels, turning to windward in narrow channels, when they want but little to weather a point, rather than make another tack, have a practice of running up in the wind till the headway ceaſes, then they

PLATE 7th.



Billinge. Sc.

they fill again upon the ſame tack: this they call making a half board. Thus a ſhip in box-hauling may be ſaid to make two half boards, firſt running with her head, then with her ſtern up in the wind, by which two motions, a ſhip if well managed, rather gains to windward, and brings the wind almoſt aft, by the time the ſternway ceaſes, ſo that ſhe is under the command of the weather helm, and the after ſails, to bring her ſhort round, on the other tack, with the firſt of the headway, in which time only it is the ſhip goes any thing to leeward worth notice, in box-hauling; therefore it ſhould always be put in practice on thoſe occaſions, by putting the ſhip in ſtays, though it is known ſhe will not come about with her head to windward; and in a gale of wind and high waves, or when there are not people enough to manage and haul the headſails, the afterſails only may be hauled, and the fore-ſheet hauled cloſe aft again, when it is perceived that the ſhip has done coming to, as is repreſented plate 7th, of a ſhip imbayed on a lee ſhore, which ſhall be ſpoken of in its place.

ON CLUB-HAULING A SHIP.

THIS is to get a ſhip from one tack to the other, by letting go an anchor, when by an eddy tide, or by a rough ſea, or being out of trim, or from any other cauſe, ſhe refuſes to ſtay or ware, in time to avoid danger. When this happens in ſhoal water, ſound by the lead, that if the ſhip has not water over her anchor, ſhe would have ſternway given her, and not headway when the anchor is let go, and the weather anchor is likelier to go clear of the ſhip than the lee one, therefore both bower anchors ſhould be ready on theſe occaſions.---Turning to windward, at ſea, will be noticed hereafter, when treating on making of paſſages.

On a SHIP driving to Windward with the Tide.

IT often happens that there is not room to turn a veſſel to windward through a crowd of ſhips, or in narrow channels, but ſhe muſt drive by the help of the windward tide.

A SHIP

A SHIP in this ſituation, muſt be managed, according to the manner you deſign to proceed, for if the tide is ſtrong enough, in proportion to the wind, ſo that ſhe will drive faſt enough to windward, ſtern foremaſt, it will certainly be the beſt, as it may be done with or without any ſails ſet, the yards being braced ſharp up, as repreſented plate the 3d, figure 1. A ſhip may be ſteered at pleaſure, and to a great nicety, end on to the tide, and ſhe will drive ſtern foremaſt in leſs room than her own length; but it will require above three times her length to drive broad-ſide, if the wind is right againſt the tide; and dexterous management is required on ſuch an occaſion, becauſe a ſhip will always ſhoot and tend towards that ſhore a head of her, ſo that you cannot drive far upon one tack, though with the ſails a back, without waring at times, to drive on the other tack, or the ſhip will ſhoot on that ſhore a head of her, of which I have ſeen inſtances in ſpite of all endeavours to back a ſtern; the reaſons of which appear to me to be as follow.

Reaſons why ſhips ſhoot a head more than they can be backed a ſtern, when driving broadſide with the tide, tho' the ſails are aback.

SHIPS in general have a longer and ſharper run aft than they have an entrance forward, the ſternpoſt and rudder ſtand more upright, than the ſtem and gripe, and they ſwim more or leſs by the ſtern; therefore the after part of a ſhip muſt be more powerfully acted upon by the windward tide, than her fore part in the water, which conſequently ſets her ſtern more to windward than her head, which at the ſame time is more acted upon by the wind above water than her ſtern, in proportion as the foremaſt, and all belonging to it, is larger and ſtands farther forward than the mizenmaſt ſtands aft, and the bowſprit, with the jibboom, and all that belong to them projecting ſo far over the bows, and nothing projecting over the ſtern to hold wind, in the ſame proportion a baft, they muſt naturally cauſe the ſhip to drive with the wind moſtly a baft the beam. And though the moſt effectual means are ſuppoſed to be uſed on ſuch occaſions, to keep the ſhip's bow to the wind, and prevent as much as poſſible her falling off and ſhooting a head, by letting her drive with the afterſails flat a back, the mizen hauled out, the helm a lee, and the headſails kept ſhivering, as is repreſented by figure 2, plate the 3d. where it appears as if a ſhip might be backed a ſtern at pleaſure, yet experience proves the contrary, and the following reaſons may be added to thoſe above mentioned. The helm muſt be kept a lee, when driving in this way, and though the afterſails are aback, the ſhip will ſhoot a head, and back a ſtern alternately, but ſhe will come to with a

ſlow

ſlow motion, by her headway, till ſhe brings the wind before the beam, which gives her ſternway and makes her fall round off upon her heel, with a quick motion, and brings the wind ſo far abaft the beam, that ſhe ſoon gets headway again, ſo that ſhe will ſhoot much farther a head than ſhe backs a ſtern, which makes it difficult to drive broadſide with the tide, right againſt the wind, in little room with ſafety,

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To drive a SHIP Broadſide to Windward, with the Tide right againſt the Wind.

IT is a maſterly and neceſſary piece of ſeamanſhip, to be able to perform this with ſafety, where there is very little room, as is repreſented plate 3d, where the ſhip figure 1. by the help of a ſtrong tide, may be ſuppoſed to have drove ſtern foremoſt, right to windward, where it was too narrow to drive broadſide, and to have got where there is but juſt room and tide enough to drive broadſide, which may make a great deal of difference in the ſhip s driving according to the wind and tide; for if we ſuppoſe the wind blows ſo freſh that the ſhip cannot be made to go leſs than at the rate of two miles an hour, through the water, when driven ſtern foremaſt, the tide muſt run at the rate of three miles, to make her drive one mile an hour to windward, but where the tide runs but two miles an hour, the ſhip will then be at a ſtand between wind and tide, but when ſhe is brought to, and drives broadſide, as repreſented by figure 2. ſhe may not drive above half a mile through the water; ſo that what the difference is between that and what the tide goes, ſo much ſhe will drive to windward.

A SHIP may drive ſternforemoſt without any ſail, as ſhe only requires ſteerage way to command her, and the leſs way ſhe has through the water, the faſter ſhe will drive, ſo that when it blows freſh, to contrive and make ſtopwaters may be of ſervice to help her to windward. But to bring a ſhip to, where there is little room, ſo as to drive broadſide, will require the three top-ſails, the mizen, and the foretop-maſt-ſtayſail, to be ready to hoiſt, to make her manageable to back, or fill, ſtay, or ware, as may be required; for ſhould we endeavour to bring a ſhip to, without ſail to throw aback occaſionally, ſhe will perhaps ſhoot on that ſhore a head before ſhe loſes her headway.

Now let us ſuppoſe that the ſhip figure 1, plate 3d. after driving ſtern foremoſt as above mentioned, has ſet her topſails braced ſharp up with the larboard braces, in order to bring to, and drive broadſide on the larboard tack. In this caſe the ſhip ſhould be ſheered as near the ſtarboard ſhore as ſhe poſſibly can with ſafety, then the helm ſhould be put hard a ſtarboard, hauling out the mizen as ſoon as it will take the right way, ſo as to bring the ſhip round to with the topſails aback, to prevent her ſhooting too near the larboard ſhore.

A SHIP bringing to with much headway, will bring the wind nearly right a head, by the time the headway ceaſes; then the helm ſhould be ſhifted hard a weather, and the ſails being aback, will ſoon give her great ſternway, by which means a ſtearnboard may be made to back her as near the ſhore a ſtern as poſſible; for, as it has been obſerved, a ſhip driving broadſide may eaſily be ſhot a head, when ſhe cannot be backed a ſtern, and this is the only time a ſternboard can be made to advantage at the ſhip's bringing to: for when the ſternway ceaſes, the helm muſt be put and kept hard a lee, and the ſhip muſt drive with the main and mizen-top-ſails aback, the mizen hauled out, and the fore-top-ſails kept ſhivering, as is repreſented figure 2, plate the 3d. and if the mizen-ſtay-ſail was ſet with the ſheet to windward, it might help to keep her more to the wind, ſo that ſhe might drive the farther on one tack, before you are obliged to ware her to drive on the other tack, which muſt be done as ſoon as the ſhip is perceived to draw near the ſhore a head, which will always be the caſe with a ſhip driving right to windward, for the reaſons given.

WHEN intending to ware, as a ſhip is always coming to, and falling off by her head and ſternway when thus driving, take the opportunity, when ſhe has juſt done falling off by her ſternway, as ſhe is then as far a ſtern as ſhe will be upon that tack, and the wind as far aft, being then all ready up mizen down mizen-ſtay-ſail, (if ſet) ſhiver the main and mizen-top-ſails, fill flat the fore-top-ſail, up jibb and fore-top-maſt-ſtay-ſail, (if neceſſary) ſhift the helm hard a weather, the tide then ſetting round the ſtern, as is repreſented by the ſhip's wake and boat to windward, figure 2, it will then act with ſuch power upon the rudder in that direction, that with the firſt of her headway, the ſhip may be wared, and proceeding as before, brought to, ſo as to drive on the other tack; in this manner a ſhip may be managed, to change tacks, and drive

right

right to windward with the tide, in leſs room than any one would think poſſible, who has not had the experience.

BUT inſtead of waring as laſt mentioned, I cannot help thinking it would be better to put the ſhip in ſtays, filling the after ſails flat, keeping the fore-top-ſail juſt drawing full, till the ſhip comes to, ſo that it will take a back to help her about, and if ſhe ſtays, let the helm lie, as it will then be a weather; the ſhip may then be backed, by making a ſternboard towards the ſhore a ſtern, at pleaſure; and if ſhe refuſes ſtays, it gives a favourable opportunity to brace the topſails a back, and box-haul her round, as has been deſcribed page 90, by which ſhe will loſe leſs ground than by waring; and the ſhip's trim may require this practice, as it is known that loaded colliers will ſtay when they will not ware, and when light in ballaſt, they will ware when they will not ſtay.

THE above management is founded on a ſuppoſition that a ſhip is to drive through a long ſtraight reach, or channel, where the tide runs true right againſt the wind.

To drive broadſide to Windward, with the Tide running a croſs the Channel, or, in a River of a winding or ſerpentine Form.

IN channels where the tide runs a croſs through ſwaſhes, &c. the ſhip ſhould be laid to drive with her head towards that ſhore the tide ſets from, and the ſetting of croſs tides is beſt perceived by ſome objects which may be found to lie nearly in the direction of the channel; obſerve nicely how the ſhip opens or ſhuts theſe marks, that the ſails may be kept aback, ſhivering, or full to ſhoot a head as the tide may require, ſo as to keep the ſhip in a fair way.

DRIVING in a crooked or ſerpentine river, as repreſented plate the 3d. the tide commonly runs winding like the river, from a point over into a bay on the other ſide, and out of the bay again paſt the next point, into the next oppoſite bay, &c. therefore at the bottom of each bay, where the tide begins to ſet out again, the ſhip ſhould be put on the other tack, to drive with her head towards the next point, as repreſented by the ſhip figure 2, by which means a ſhip may be backed a ſtern, ſo as to drive clear of the ſhore a head, upon both tacks.

WHEN the wind blows a point or two of the compaſs, acroſs a tide that runs true, a ſhip driving with her head towards the weather ſide may be eaſily managed, ſo as to keep in a fair way, by backing, filling, or ſhivering the ſails, and the more the ſails can be kept ſhivering, the faſter the ſhip will drive.

THOUGH a windward tide helps a ſhip to work, and makes her manageable when driving to windward, yet it is very neceſſary to have an anchor ready to let go, as occaſion may require.

ON BRINGING A SHIP TO AN ANCHOR.

VARIOUS ſituations and different ſorts of harbours, roads and coaſts, and different directions and ſtrength of winds, waves, and tides, make it impoſſible to fix certain rules to bring a ſhip properly to an anchor, at all times and places. Yet in my opinion, a great deal may be ſaid on the ſubject, deſerving notice. ---And firſt it may be neceſſary to make ſome remarks on coiling cables.

ON COILING CABLES.

IT may occaſion the loſs of a ſhip, to coil a new cable with the ſun, as it is termed, before it is properly ſtretched, or the end taken through the coil, for it is almoſt ſure to come up in kinks when veered out, and eſpecially in cold weather. The greateſt dependance being on new cables, they are commonly kept in reſerve till the other cable, or the anchors give way, which makes this bad practice in coiling them the more dangerous; therefore it ſhould be firſt conſidered, how to manage the cables, to make them work and coil to the beſt advantage, and run clear of catch-fakes, as well as kinks.

A CABLE in my opinion, works and wears much better for being coiled the ſame way that it runs round the windlaſs, or bits. Therefore the cables for the ſtarboard anchors, which work round the windlaſs againſt the ſun, ſhould be coiled againſt the ſun, and thoſe for the larboard anchors coiled with the ſun, as they work that way round a windlaſs, and as they run out round the bits the contrary way, ſo that the cables ſhould be coiled accordingly. And

to

to make new cables anſwer this practice, is, the firſt time, to coil them with the ſun, over the cable tier hatchway, with larger or leſs fakes, according to the limberneſs or ſtiffneſs of the rope, and take the upper end through the coil, to coil it down in the tier; this will make the rope pliable to coil, and veer out eaſy, clear of the kinks, either with or againſt the ſun.

To coil a cable to run clear of catch-fakes, the cable ſhould always be laid out from the inſide fake to the outſide fake, at the farther end of the cable tier, fartheſt from the hatchway; this will likewiſe coil the cable ſo much lower in that part near the hatchway, ſo as to give more room and height to bend and coil the cable, and for the bends to upſet clear when veering away.

THE bad cuſtom of coiling cables with the ſun, ſo as to run in kinks proceeds firſt from the rope-makers, who for their eaſe, coil them that way to ſend to the ſhip, where, without thought, they are too commonly coiled down the cable tear the ſame way, becauſe a new cable before it is well ſtretched, will always bend of itſelf in that way of coiling, for the rope opening againſt the lay, gets clear of a turn at the bend of every fake, which is the reaſon that a new cable bends and coils ſo eaſy this way, but when this cable comes to be veered out, this turn muſt come into the cable again at the upſetting of every bend; but the lay of the rope inclines it to keep clear of this turn, which prevents the fakes from upſetting, and cauſes it to come up in kinks, by which bad practice I have known manny narrow eſcapes. Therefore all new cable-laid ropes, hauſers, and towlines, as well as cables that require to run clear of kinks, ſhould be either coiled againſt the ſun, till they are well ſtretched, or with the ſun, and the end taken through the coil as before mentioned; for the ſame reaſon, as it is well known, that a coil of new rigging will not run clear of kinks, without the end is properly taken through the coil. But to coil a new cable againſt the ſun, that is, from the right hand to the left, requires a turn to be forced into the lay of the rope, at the bend of every fake, which makes the bends upſet of themſelves, ſo that the cable veers out very eaſy.

Now if we may ſuppoſe that the anchors and cables are all ready, ſo as to be ſure of running clear, the next things to be conſidered, are the depth of water, the room, ſtrength of the wind, waves or tide, where you expect to anchor; alſo that the buoy, and buoy-ropes, range of cable, handſpikes, ſtoppers, ring-ropes, and buckets of water to throw on the windlaſs or bits, be all ready,

ready, as occaſion may require, and to give as great a ſcope of cable as the place will permit, before you offer to bring the ſhip up, becauſe the length and weight of the cable, will contribute greatly to eaſe both the anchor and cable, as well as the ſhip, when the waves run high, for which reaſon, I have known ſhips have the inner ends of the ſheet, and beſt bower cables ſpliced together, ſo that by overſetting one cable, they could veer out both upon one end, to either anchor, if neceſſity required it, for it is well known, in a ſtorm when rhe waves run high, and eſpecially in deep water, that a ſhip will ride much eaſier and longer by two cables, or more upon one end, to one good anchor, than by two anchors with a ſingle cable to each. For to ride by two anchors, they muſt lie far enough aſunder on each bow, to prevent one anchor from hurting the other cable, by which means a ſhip ſeldom pulls hard upon both cables at the ſame time, but firſt pulls hard upon one cable; if but a ſhort ſcope, it plunges her deep into the ſea: then that ſtrain draws the ſhip towards that anchor, which ſlackens that cable; ſo that by the next wave ſhe ſtrains hard upon the other cable, and ſo on, ſhe pulls firſt at one and then at the other, which cauſes a ſhip to labour, and be very uneaſy in the waves, in compariſon to what ſhe would be, if riding by one good anchor and a great ſcope of cable, which admits the ſhip to fall and riſe eaſy with the waves, without hauling the whole length and weight of the cable off the ground, which makes the anchor hold longer without coming home.

IN letting go an anchor, care ſhould be taken that the ſhip does not hurt herſelf upon it, in caſe of ſhoal water, and that the anchor is not fouled by the cable getting about the fluke or ſtock of the anchor, which may prevent its holding the ſhip when any ſtrain comes upon it.

To come to an Anchor when the Wind is right againſt the Tide.

IT ſhould be a rule to ſhoot the ſhip a head of the anchor, or ſheer her clear of it, upon the ſame tack you deſign to ſhoot her upon, the next tide, endeavouring always to keep the ſhip in ſwinging with the tide on one ſide of the anchor, to keep clear of it, for reaſons that will be given in their place on keeping a clear anchor. As is repreſented plate the 3d. it may be ſuppoſed that the

the ſhip driving to windward has got to an anchoring birth, or the tide is ſo far ſpent that ſhe will drive no farther to windward, and muſt come to an anchor on the ſtarboard tack. In this caſe at letting go the anchor, the ſhip ſhould be ſhot a head of it, and kept a head with the helm a weather, and the yards braced full with the larboard braces, and the fore-top-maſt-ſay-ſail and mizen ſet full, as is repreſented by figure 3, plate the 3d. till the windward tide is done, that ſhe falls to leeward and rides windroad, with the wind, anchor and cable right a head, as repreſented figure 4, plate the 3d. in which poſition ſhe will lie clear of the anchor till the next windward tide.

To come to an Anchor when going with a ſtrong Wind and Tide the ſame Way.

WHERE there is room, it is certainly neceſſary to furl the ſquare-ſails, as the ſhip is running before the wind and tide, and to bring her to, by putting the helm hard over to ſtarboard or port, and haul out the mizen to bring the ſhip's head up as much as poſſible, againſt the wind and tide, at letting go the anchor, which will contribute greatly to bring the ſhip up with ſafety and eaſe, compared with that bad practice of letting go the anchor as the ſhip runs right before the wind and tide, without handing the ſquare-ſails, which adds all that extraordinary force of the ſhip's way through the water, to the ſtrength of the wind and tide, and thus increaſes the ſtrain and rubs the cable to a dangerous degree, by which I have ſeen great damage done, as breaking the cable, &c. which might have been avoided by bringing the ſhip to, and letting go the anchor, as above recommended.

THE damage that is often done on this occaſion, proceeds from want of conſideration; for as it has been obſerved before, a ſhip ſailing right before the wind, and a ſtrong tide, does not feel the real ſtrength of the wind; therefore apprehending no danger, they let go the anchor as the ſhip runs, which if it does not make ſomething give way, muſt greatly ſtrain every thing that is immediately concerned in bringing the ſhip up.

To come to an Anchor, with the Wind right a croſs the Tide.

WHERE it can be done, the ſhip ſhould be always put upon that tack that ſtems againſt the tide, when the anchor is let go; and if it is deſigned to continue at a ſingle anchor, in order to keep it clear, I would recommend to ſheer and keep the ſhip to leeward of the anchor, by keeping the helm a weather, and the fore-top-maſt-ſtay-ſail ſet with the ſheet to windward, as repreſented by the ſhip figure 1, plate 4th. for the reaſons which will be given, when treating on keeping a clear anchor.

GREAT advantages may attend letting go the anchor ſtemming againſt the tide, and eſpecially where the tide runs very rapid, for it gives an opportunity to take notice at what rate the ſhip may be going a ſtern, ſo as to judge whether it may not be neceſſary to keep ſail ſet, in order to bring the ſhip up, and ride eaſy in a rapid tide. I have been where we let go the ſmall bower anchor, with all ſails ſet, with a freſh breeze of wind againſt the tide, and veered out the whole cable, and the ſhip ſtill drove; then we let go the beſt bower anchor and veered out all that cable, by which the ſhip brought up, and rode ſo cloſe to a ſhoal a ſtern, that we were obliged to ride with the helm a port, to keep the ſhip with a broad ſheer, to prevent her touching the ground, which would have overſet the ſhip, broke away her maſts, and turned her over, and over upon the ſhoal, and this would probably have been the caſe, had it not been for the ſails being kept ſet, which helped to bring the ſhip up, and enabled her to ride againſt this very rapid tide.

To come to an Anchor at Slack-tide, or ſtill Water where there is neither Tide or Current.

IT is expected in this caſe, that the ſails are taken in, as the ſtrength of the wind, and ſituation may require, to bring the ſhip up with eaſe; in moderate weather, and where there is room, it is certainly beſt to bring the ſhip to under the topſails, throwing her head up to the wind, by putting the helm a lee, with the top-ſails lowered down or clued up; and when the ſhip is perceived to get ſternway, then let go the anchor to the ground, but veer out

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no more cable but as the ſhip takes it, by driving to leeward from the anchor, as repreſented by the ſhips, figure 2 and 3, plate the 5th, and not offer to bring the ſhip up, till it is thought that ſhe has a ſufficient ſcope of cable to ride her, on which it depends to make the anchor and cable hold, as the occaſion may require.

To come to an Anchor in Roads that are often crowded with SHIPS, ſo as to take and give good and clear Births.

THE beſt anchoring births in theſe places are commonly well known by marks, and the firſt ſhip naturally takes up, and has a right to keep one, clear from any other ſhip anchoring ſo near, as to make her a foul birth, as is repreſented by plate the 5th, where the ſhip figure 1, may be ſuppoſed to be come to an anchor, in the beſt birth, having the caſtle and windmill in one line, and the houſes and church in another line of direction, pointing exactly to the anchor; theſe particulars ought to be wrote down in the log book, as ſhould likewiſe the bearings by the compaſs, of extreme points of land, ſhoals, rocks, or ſands, all which it may be neceſſary to remark, ſo that a courſe may be ſteered to keep clear of them, if the ſhip ſhould be drove from her anchors in the night, or in thick weather, and that the anchors may be found again by the marks made when they were let go, if their buoys ſhould diſappear.

IF it is a tide, or trade wind road-ſtead, the next ſhip that comes ought not to anchor right a head, or a ſtern, of the firſt ſhip, ſo as to lay in each others hauſe, but ſhould come to on the bow and quarter, at a proper diſtance, to prevent other ſhips from coming between, and in a ſlanting direction from the tide or wind, as is repreſented by the ſhips, figure 2 and 3, plate the 5th. This in my opinion might contribute to the ſafety of ſhips in ſuch places as the *Downs*, *Yarmouth Roads*, or the *Weſt Indies*, and other ſuch places, that may be crowded with ſhips; when it happens to blow ſtrong upon a lee tide, or in ſtrong ſea breezes in the *Weſt Indies*, each ſingle ſhip may then veer away what cable may be thought neceſſary, and keep clear of the other ſhip's hauſe a ſtern, or in caſe of driving or caſting, this gives a better chance to keep clear of each other.

A FRIEND told me that he often got a good anchoring birth in the *Weſt India* road-ſteads, by firſt running down through the middle of the fleet, where he often perceived good births left vacant, by ſome ſhips that had ſailed from the middle of the fleet: then he ſteered out from among the ſhips, and turned to windward of them all, ſo far as to give time to take in and furl all the ſails, and run down before the wind amongſt the ſhips, without any ſail, and let go the anchor at the deſigned birth, which he could not have come at by any other means. The like practice may anſwer the ſame purpoſe at other times and places.

To come to an Anchor when deſigned to moor with the beſt and ſmall Bower Anchors.

IN places expoſed to waves, from one quarter more than another, and if the ſhip is to lie for ſome time, expoſed to all the various winds that may blow, it ſhould be made a rule to let go the firſt anchor, ſo that the ſhip may be moored with the ſecond anchor, to lay with an open hauſe towards the ſea, or the moſt open or worſt part of the road, or river, where the greateſt waves can come from, to give the ſhip violent pitching motions, which are always very deſtructive to the cables when riding hard with a croſs in the hauſe, for which reaſon the croſs in the cables ſhould always be towards the ſmooth water quarter.

To let go all the Anchors to the beſt Advantage, when that is the only Chance left to keep the SHIP off a Lee Shore.

THIS deſperate occaſion happens when the anchoring ground lies leſs than two cables length from the lee ſhore, or when the ſhip is only that diſtance from it, with the wind and waves ſo high, right upon the ſhore, that it is found impoſſible for the ſhip to keep off the ſhore with all the ſail ſhe can carry; ſo that ſafety muſt depend entirely on the management of the ground tackle.

IN ſuch a dangerous ſituation, where, if one anchor or cable fail, there is not room to bring the ſhip up by another, (and it is counted a great diſgrace to let a ſhip go on ſhore with any ground tackle

tackle on board, that might have been uſed to help to ride her,) therefore the utmoſt endeavours ſhould be uſed to let go all the anchors, a little diſtance from each other, and as much as poſſible in a line along the ſhore, that one anchor may not hurt another cable, and that the cables lead clear of each other, and be made to bear a ſtrain in proportion to their ſtrength, to help to ride out the ſtorm.

To put this difficult performance in practice, I would recommend to get the ſquare-ſails handed, with the quickeſt diſpatch poſſible, but to keep the fore-top-maſt, main, and mizen-ſtay-ſails ſet, the yards braced full, and the helm put hard a weather, to keep headway upon the ſhip, ſhooting her along the ſhore, as much as poſſible, till all the anchors are let go, contriving to begin with the weathermoſt anchor, or that which has the cable in the weathermoſt hauſe-hole, and ſo on with the next weathermoſt anchor, paying out the cables as faſt as poſſible, that the ſhip may keep ſhooting a head till the anchors are all let go.

ON KEEPING A CLEAR ANCHOR.

IT is allowed to be a maſterly and material branch of ſeamanſhip, to be able to manage a veſſel riding in a tide way, by a ſingle anchor, ſo as to keep it clear from the cable getting foul of the fluke, or ſtock, and ſometimes foul of both fluke and ſtock, which may be the caſe; and the anchor thus being fouled, as it is termed, prevents its holding the ſhip, and may occaſion her to drive on ſhore, or athwart another ſhip's hauſe, which often happens from the want of proper methods being put in practice to keep the anchor clear: This therefore deſerves the utmoſt regard, for in open road-ſteads, when only waiting for a fair wind, it may be better and ſafer to ride by a ſingle anchor, than to be moored when it blows hard, and among many ſhips, which are liable to drive athwart each others hauſe, ſo that to ſave both ſhips, the leewardmoſt muſt be obliged to cut or ſlip; if riding by a ſingle anchor, they have only one cable to get clear of, but, if moored with the two bowers, they have two cables to get clear of and that perhaps at a time when both ſhips and men may ſeem to be the ſport of wind and waves, which may make one ſhip to riſe whilſt the other falls, and tear in pieces even our heart of oak,

and make our ſeamen's hearts of oak, which we boaſt ourſelves ſo much upon, to fail, for what chance do feeble men ſtand, to fend off the blows one ſhip gives the other, at ſuch times of diſtreſs, when nothing is heard but the craſhing of timber, &c. and crying out for the leewardmoſt ſhip to cut, to relieve them, ſo that if moored, and ſhe muſt part with both anchors, ſhe may have only one anchor left to bring her up again, and ride by, and ſafety may ſtill depend on keeping that clear; all which prove the great neceſſity of endeavouring, after fixed rules, to keep a ſingle anchor clear.

To keep a clear Anchor, with the Wind right againſt the Tide.

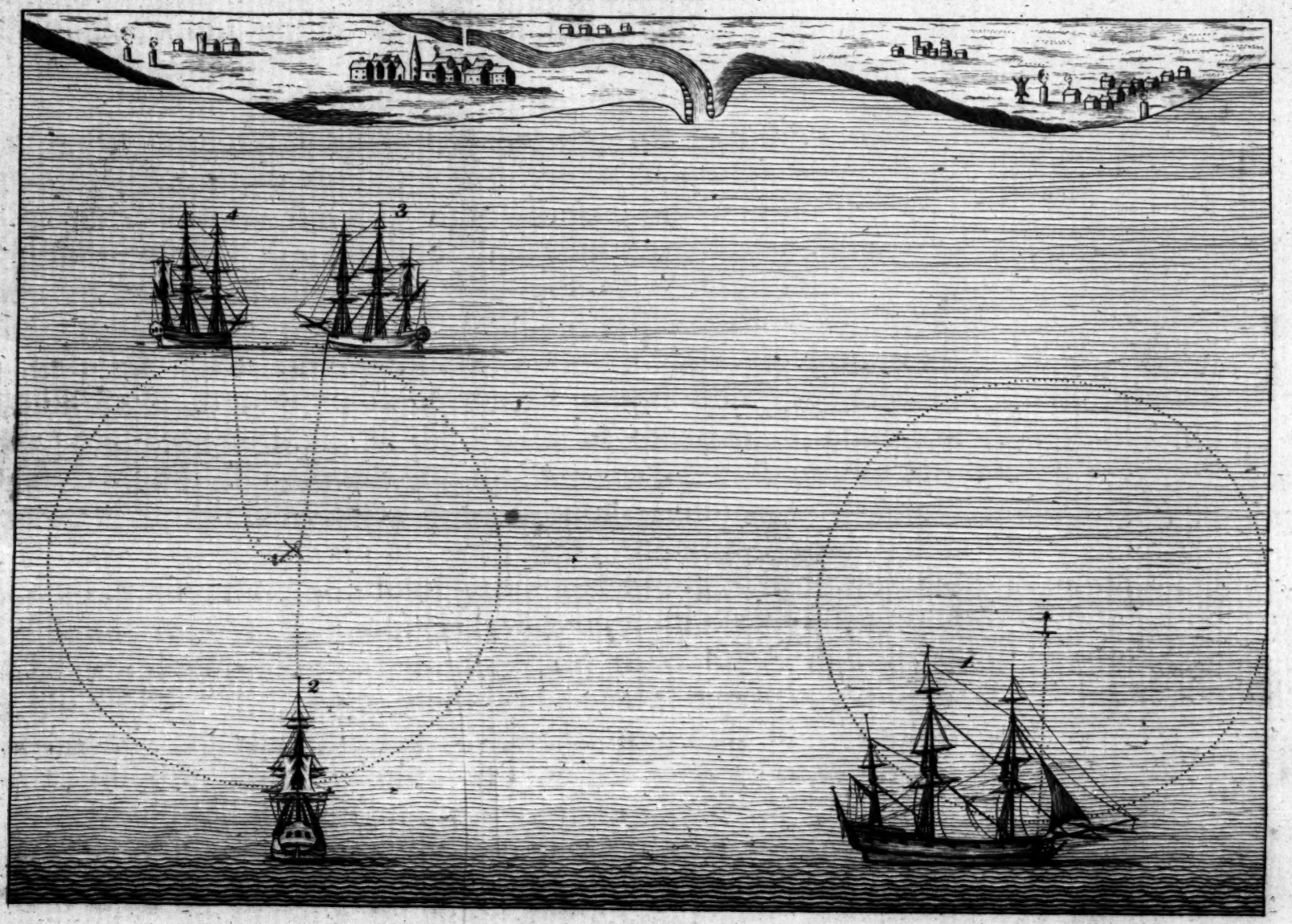
IT ſhould be a fixed rule on this occaſion, at the tide firſt ſetting to windward, to ſhoot the ſhip a head of the anchor, to keep it clear, and not to offer to back her a ſtern of it, for that is found by experience to be impracticable, not only for the reaſons given page 88, on a ſhip driving broadſide, but becauſe when the cable is lying upon the ground, the ſhip ſwinging with the tide, will bring the wind ſo much abaft the beam, that it will be impoſſible to back the ſhip a ſtern, clear of her anchor; yet I have ſeen this attempted in capital merchant's ſhips; and even in his Majeſty's ſervice I have ſeen ſome expoſe their ignorance in this important point of duty.

IT ſhould be another fixed rule, always to endeavour to ſhoot or ſheer a ſhip on the ſame ſide of the anchor each tide, to avoid the riſk of the anchor not turning in the ground, as the ſhip goes round it, as ſhe will do when ſhe is let go at random, on one ſide of the anchor one tide, and on the other ſide of it the next, by which bad practice the cable is liable to get foul of the upper fluke of the anchor that is above the ground.

THIS caſe I muſt refer back to the example page 94, where the ſhip figure 4, plate the 3d. is deſcribed to be managed according to the above rules, when ſhe was brought to an anchor, and was ſhot a head of it on the ſtarboard tack; ſo that when the windward tide makes again, ſhe ſhould be caſt and ſhot a head of her anchor upon the ſame tack, as before repreſented figure 3, plate the 3. until ſhe ſwings to windward of the anchor, and comes to a proper ſheer, with a tight cable growing on the larboard bow,

and

PLATE 4th.



and the wind on the ſtarboard quarter, keeping her on this ſheer with the helm a port; then the ſails may be taken in, till the windward tide ſlacks, for there is no danger of a ſhip breaking her ſheer, whilſt the tide runs ſtrong, in proportion to the wind that keeps her ſtern of the anchor; but when the tide ſlacks, or the wind becomes ſo ſtrong, that the ſhip ſhoots end on upon the tide, a head of her anchor; then is the time ſhe is liable to break her ſheer againſt the helm, and requires aſſiſtance with ſail, and the yards to be braced about, to prevent her from falling over her anchor, and fouling it.

BUT to caſt the ſhip, figure 4, on the ſtarboard tack, as above mentioned, when the lee tide is done, the head yards ſhould be braced up ſharp with the ſtarboard braces, the after yards with the larboard braces, the fore-top-maſt-ſtay-ſail ſet with the ſtarboard ſheet hauled flat aft, and the helm hard aport; then the windward tide coming right aft, acts upon the larboard ſide of the rudder, in a direction ſuch as will cant the ſhip's ſtern to ſtarboard, and the wind at the ſame time acts upon the fore-top-maſt-ſtay-ſail, and the head yards, to caſt her head to port upon the ſtarboard tack. And ſuppoſe that, by the ſetting of the tide, or other accidents, contrary to your deſign, the ſhip ſhould caſt on the larboard tack, in that caſe, every thing is ready trimmed, as it ſhould be, to ware her round on the other tack, the helm being aport, is now hard aweather, the head yards and fore-top-maſt-ſtay-ſail flat full, the after yards braced the other way, all act together, and will bring the ſhip round on the ſtarboard tack, before ſhe comes near her anchor; then the mizen may be hauled out, and the fore-top-maſt-ſtay-ſail, and head yards ſet drawing full, to ſhoot her a head, till ſhe drives to windward of the anchor, with a tight cable as before deſcribed.

BUT to caſt a ſhip the right way at an anchor, with a windward tide, is beſt repreſented plate the 5th, with a ſide view of the ſhip, figure 1, to caſt her upon the larboard tack, when the lee tide ſlacks, the helm is put aport, to ſheer the ſhip and bring the wind on the larboard bow, then ſet the ſpritſail and ſpritſail topſail, topped up to port, the jibb and fore-top-maſt-ſtay-ſail with the larboard ſheets flat aft, and the jibb ſheet under the ſpritſail-yard-arm to guy the ſail further out to port, the head yards braced ſharp up with the larboard braces, the after yards with the mizen-top-ſail ſet braced ſharp up the other way; ſtrict notice ſhould be taken when the lee tide is quite done, to put the helm

hard

hard a ſtarboard, ſo that the windward tide acting upon the ſtarboard ſide of the rudder in that direction, and the wind upon the ſails and yards makes them evidently tend to caſt the ſhip the way deſigned, and when ſhe is caſt you have only to fill the head ſails and yards, to ſhoot her a head with a tight cable, till the tide ſets her to windward of the anchor, or ſwings her near end on the tide, and brings the wind on the larboard quarter; then the head ſails ſhould be taken in, and the head yards pointed to the wind with the larboard braces, and if ſhe continues to ride a head of the anchor, which ſhould be ſtrictly noticed by the buoy, or the growing of the cable, more after-ſail ſhould be ſet, the mizen and mizen-ſtay-ſail added to the mizen-top-ſail, to help the ſtarboard helm to keep the ſhip from breaking her ſheer againſt the helm, and bringing the wind on the ſtarboard quarter; when this happens with theſe ſails ſet, the mizen and mizen-ſtay-ſail muſt be immediately taken in, ſhiver or keep drawing full the right way the mizen-top-ſail, ſet the jibb or fore-top-maſt-ſtay-ſail, the yards and helm being trimmed the right way, as before mentioned, to keep clear of the anchor, and bring the ſhip round on her proper ſheer again, with the wind on the larboard quarter; then down headſails, and endeavour to keep her on this ſheer, as before directed, till the windward tide is done.

On keeping a clear Anchor when the Wind blows a Point or two a-croſs the Tide.

IN this ſituation, when the tide makes to windward, it will naturally caſt the ſhip with her head towards the weather ſide, and for the reaſons before given, will ſwing her, to bring the wind ſo far abaft the beam, as to prevent backing her a ſtern of the anchor to keep it clear: therefore I would recommend to ſhoot her a head of the anchor to the weather ſide, till ſhe comes to her proper ſheer; the wind being on the quarter a little a croſs the tide, will keep her from breaking her ſheer, whilſt the windward tide runs, and ſhe may be eaſily ſhot a head on the ſame ſide of the anchor, again, as before deſcribed, when the windward tide is done.---But whenever the wind blows ſo far acroſs the tide, that the ſhip can be ſheered and kept to leeward of her anchor, I recommended

recommended this as much the beſt practice to keep a clear anchor.

To keep a clear Anchor, with the Wind right a-croſs the Tide.

I STRONGLY recommend the ſimple and eaſy method of ſetting the fore-top-maſt-ſtay-ſail with the weather ſheet flat aft, and the helm aweather, whereby the ſhip may be ſheered, and kept near the ſame place to leeward clear of her anchor, both flood and ebb, as repreſented by the ſhip figure 2, plate the 4th. But this method of ſheering a ſhip to leeward is quite contrary to that bad cuſtom which is practiced in the coal trade, of ſheering ſhips to windward of the anchor, and though I allow them to be the greateſt proficients in managing ſhips in narrow and difficult channels, yet I hope to convince them that their practice in this inſtance is wrong. But Dame Cuſtom, I know from experience, is a powerful adverſary, and a great enemy to improvements, and will ſeldom ſubmit to conviction; notwithſtanding that, I ſhall endeavour to make a fair compariſon, by deſcribing both methods, as they are repreſented in plate the 4th, which was made for this purpoſe only, and then leave the merit of both to the determination of impartial judges. Firſt, then let us ſuppoſe the wind to be off ſhore, and right a-croſs the tide, as is repreſented plate the 4th, and that the ſhip figure 1, is commanded by Capt. Reaſon, and came to an anchor on the larboard tack, ſtemming againſt the tide, as deſcribed page 95, with her helm aweather, to ſheer the ſhip to leeward of the anchor, which method not only keeps the ſhip clear of her anchor, but alſo makes her ride ſo near end on to the tide, with the wind rather abaft the beam, that ſhe may be helped with ſail, to ride eaſier in a rapid tide; and when the tide is moderate, ſhe will lie ſheered right to leeward of her anchor, where ſhe muſt be at each ſlack tide, as has been before obſerved. And if we ſuppoſe that ſhe came to anchor at ſlack tide, as deſcribed page 95, ſhe will then lie with the cable and anchor in the ſame direction, with the wind right a head; ſo that when either tide makes, ſo as to bring the wind upon the bow, they have only to hoiſt the fore-top-maſt-ſtay-ſail with the ſheet to windward, and put the helm aweather, to keep the anchor clear, as you ſee repreſented by figure 1, plate the 4th.

Now

Now we will ſuppoſe Dame Cuſtom commanding the ſhip figure 3, in the ſame plate, comes to an anchor on the ſtarboard tack, ſtemming againſt the tide, and puts the helm a lee, which ſheers the ſhip, and lays her anchor in a ſlanting direction to windward, as repreſented by figure 3, till the tide begins to ſlack; then ſets the mizen-top-ſail aback, and in little wind, ſometimes adds the main-top-ſail aback, to back the ſhip a ſtern, clear of her anchor, according to her ſcope of cable, from her being near right to windward to right to leeward of her anchor, as repreſented from figure 3, to figure 2, where the ſhip muſt naturally lie in that ſituation every ſlack tide, with the wind and anchor right a head, till the other tide makes; then they ſhift the helm a lee, brace aback the mizen-top-ſail and yards, &c. and ſheer the ſhip nearly right to windward on the larboard tack, to complete almoſt the circle quite round her anchor every tide, as repreſented from figure 3, to figure 4, where it appears plain, the ſhip is made to take up above twice the room of the ſhip figure 1, conſequently in that proportion her cable rubs over twice as much ground, is more liable to ſweep foul of ſtones, wreck, or loſt anchors, &c. which may greatly hurt it, and it may get under the upper fluke of her own anchor, if the anchor does not turn in the ground as the ſhip is ſheered round it, which probably will be done at the laſt and firſt part of the tide, when it runs eaſy; when if the wind is moderate, and the bottom a tough clay, it is great chance but the anchor lies with the ſtock to windward, by the ſtrain upon in that direction, as above mentioned, and the cable may go over the ſtock when lying flat upon the ground, as the ſhip was backed to leeward of the anchor, and may ſweep under the upper fluke as ſhe is ſheered to windward again, which makes it evident, that by this practice, Dame Cuſtom is likely to ride with the cable foul of the upper fluke of the anchor, as repreſented figure 4. And to ſuppoſe the wind and tide ſo moderate, that the ſhip does not drive, yet the ſtrain upon the upper fluke may cant it towards the ſhip, and raiſe the farther ſtock arm off the ground, by which in a clay bottom, the anchor may perhaps lie in that poſition, ſo that when the tide ſlacks, and the ſhip is backed from figure 4, to figure 2, it will clear the cable of the anchor fluke; and as they ſheer to windward again, from figure 2 to figure 3, the cable is likely to ſweep under the anchor ſtock arm, that lies canted off the ground. I defy the adherents of Dame Cuſtom to account for their cables ſo often getting under

the

the anchor ſtock, which naturally lies flat upon the ground, but from this bad practice.

AGAIN ſuppoſe Dame Cuſtom comes to an anchor at ſlack tide, the anchor will naturally lie in the ſame direction with the ſhip and wind right a head; and when the tide makes, inſtead of keeping the ſhip to leeward, as repreſented figure 1, then the old Dame ſheers and lies to windward of the anchor, as above mentioned; and ſuppoſe the wind to change, and come ſo far abaft the beam that the ſhip cannot be backed a ſtern of her anchor, but ſhoots a head as the tide ſlacks, in this caſe, if it is good holding ground, we may reaſonably ſuppoſe that the anchor has not turned in the ground as the ſhip has gone round it; the cable will then naturally ſweep the upper fluke of the anchor, ſo that Dame Cuſtom is likely to be adrift with the lee tide, if it blows freſh, or the tide runs ſtrong, and may carry other ſhips adrift with her, which makes it dangerous for Reaſon to lie near Dame Cuſtom, in crowded road-ſteads, and it muſt make great confuſion when one ſheers their ſhip to leeward, and the other to windward of their anchor, they may ſheer on board each other, which I have known to be the caſe, and Dame Cuſtom has then abuſed Reaſon, by calling him lubber, for ſheering the ſhip to leeward of her anchor, when Reaſon, who had obſerved their wrong proceedings, wagered in his own defence, that Dame Cuſtom's anchor was then foul, which proved to be the caſe at heaving it up.

THERE is ſo much to be ſaid againſt this bad cuſtom, of ſheering to windward of the anchor, that I am ſurprized how it came into practice, ſince nothing reaſonable as appears to me, could be urged in favour of it; even in reſpect to work, to wear and tear, they all are greatly againſt it; ſo that I will adviſe every ſhip, commanded by Reaſon, to reſort and lie together, as far from the adherents of Dame Cuſtom as the room in the place will admit of; as they all ſheer one way, to leeward of their anchors, they may lie with much more ſafety clear of each other, in leſs than half the compaſs of the ground that Dame Cuſtom takes up, as is made evident by plate the 4th, which I hope will prove ſufficient to condemn the practice.

IT is but fair that we remark what effect the change of wind might have upon the ſhip figure 1, to leeward of her anchor, when it made Dame Cuſtom foul her anchor by being to windward of it, as mentioned above. Suppoſe then that the wind comes four points abaft the beam; as long as the fore-top-maſt-ſtay-ſail,

with the ſheet to windward, will keep drawing the right way, and the helm is hard aweather, Reaſon, to leeward of his anchor will never come near to foul it; and to ſuppoſe by the force of the wind the ſhip ranges a head of the anchor, that ſhe breaks her ſheer, it will be with her head to leeward, clear of the anchor, till the tide drives her a ſtern of it again; ſo that whilſt a ſhip by this method can be kept to leeward of her anchor, ſhe ſhould never be ſheered to windward of it.

ON MOORING SHIPS.

RULES cannot be fixed to ſuit all places and all ſhips, but different methods may be neceſſary, according to the road, the ſize of the ſhip, her draft of water, and how ſhe may be provided with ground tackle, &c. Where the tide runs very ſtrong, and there is water enough, it is certainly beſt to moor water ſhot, the anchors and cables lying in the ſame direction with the tide, which can then have but little effect upon them, in compariſon to what it has when a ſhip is moored a-croſs the tide, where the power of the tide alone upon the moorings, is of itſelf ſometimes enough to bring the anchors home. Therefore great ſhips that have ſheet anchors, and are well manned to clear the hauſe, when obliged to lie where the tide runs ſtrong, moor with the beſt and ſmall bower anchors, water ſhot; but ſmall ſhips having only two bower anchors, and but few hands to clear the hauſe, drawing leſs water, may moor out of the ſtrength of the tide, with the ſmall bower and ſtream anchor, and hauſer athwart the tide, and keep the beſt bower anchor in reſerve, as occaſion may require.

WHEN a ſhip is to be moored only to wait for a fair wind, the beſt anchor, and open hauſe, ſhould be towards the foul wind quarter; but when a ſhip is to lie with all winds that may blow, the beſt anchor and open hauſe ſhould be towards the worſt wind that may blow, to raiſe the waves, and give the ſhip a pitching motion, as is mentioned page 98, and muſt leave no more of the ſmalleſt moorings within board, than juſt enough to freſhen the hauſe on occaſion; by which they will hold the longer, by having the longer ſcope, and the hauſe will be the eaſier cleared.

WHERE a ſhip is liable to ground with the ebb, and not to float till the flood tide runs ſtrong, the ſafeſt method is to moore

a-croſs

a-croſs the tide, which lays the ſhip clear of getting damage upon her own anchors; when it requires to attend and ſlack the mooring, that her ſtern may ſwing over upon the flood, to prevent her girting. And when moored with a ſmall anchor and hauſer, the helm ſhould be always ſhifted, to ſheer her towards the ſmall anchor, to eaſe the ſtrain upon the ſmall moorings; and to lay the principal ſtreſs upon the bower anchor and cable, to ride the ſhip when the tide runs ſtrong.

I HAVE been mooring a ſhip in a very narrow river, where the ſhore on each ſide was nothing but looſe ſhilly ſtones. We laid the bower anchor cloſe over to one ſide of the river, and made faſt a hauſer with a long bowline knot, to the middle of a twelve feet deal board, on the oppoſite ſhore under the ſhilly ſtones, broadſide, and its lower edge a little ſlanting, towards the ſhip, which held her better than an anchor would have done in its place. Another remark of this kind, which I think deſerves notice, is what I have known done, where anchors placed one to back another could not be made to hold in ſand:---a bulky bundle, made of ruſhes that grow on ſand hills, buried under the ſand, and trampled upon, has held ſo that it would break a cable made faſt to it; and no doubt but any thing of the ſame bulk would anſwer the ſame purpoſe.

ON KEEPING A CLEAR, OR OPEN HAUSE.

IN roads where ſhips are liable to be put in great motion by waves, which may make dangerous deſtruction of the moorings with a foul hauſe, the danger and trouble there is in clearing it, when the waves run high, make it highly neceſſary to endeavour to cauſe the ſhip to ſwing the right way each tide, to keep the hauſe clear, which the wind will do when it blows a-croſs the tide, as may be ſuppoſed in plate the 5th, and that the wind was off the ſhore a-croſs the tide, when the ſhip figure 1, was moored with an open hauſe towards the ſhore, to wait for a fair wind; whilſt that wind continues, the ſhip will ſwing with her ſtern from the ſhore, and keep a clear hauſe without any trouble, but when the wind comes to blow right oppoſite to one tide, and in the ſame direction with the other tide running along the ſhore, as repreſented by the ſhip figure 1, plate the 5th, then it requires

management to make the ſhip ſwing with her ſtern from the ſhore, to keep the hauſe open on both tides. The method of proceeding the firſt part of the windward tide, when the wind is right a head, is fully deſcribed page 100, and to ſwing a ſhip the latter part of a windward tide, when the wind is right aft, requires only to put the helm over that way her ſtern is to go, as in this caſe to ſtarboard, which will bring the wind on the larboard quarter; if it is little wind, the mizen, mizen-ſtay-ſail, and mizen-top-ſail braced up ſharp, may be ſet, to aſſiſt the helm as the tide ſlacks, to ſwing her the right way to keep the hauſe clear, without the trouble of towing with a boat, running out a rope, and a ſmall anchor, &c. which a calm, or the ſetting of the tide may ſometimes require to be done.

On ſerving Cables to prevent their Chafing.

AS ſafety may often depend upon this, not only when the waves run high, but in ſmooth water where the tide runs ſtrong, and by giving the moorings a trembling motion, may chafe them, therefore care ſhould be taken to have them well ſerved, not only in the way of the hauſe and cut-water, but ſo far as to reach below the gripe; for if a ſhip be moored water ſhot, or at a ſingle anchor, with a windward tide, when it blows ſo freſh that ſhe ranges about, and lies a head of her anchor, with a tight cable, the cable may be hurt under the bows and gripe, if not ſerved low enough, with rounding and keckling. Therefore it is certainly beſt to have the cables properly ſerved ready for mooring, as the time and place the ſhip is to lie in may require, as our *Eaſt India* ſhips in the paſſage home, when in a fine weather climate, put the proper ſervice on their mooring cables; and in the coal trade to *London*, they put on their cables what they call a long and ſhort ſervice, to continue on for the ſummer's work.

THE beſt ſervice that I know to preſerve a cable from chafing in a ſtorm, when the waves run high, is ſuch as is uſed in the coal trade to *London*; it is cut from the beſt part of a tanned horſe hide, big enough to wrap two or three times round the cable, which is readily and eaſily put on and taken off, and much better than the plats commonly uſed in merchant's ſhips, which are long and troubleſome to paſs, and beat about the cable; and after that

are

are liable to become ſlack as the cable ſtretches, and rubs backward and forward in the hauſe; and when the ſhip pitches hard, it ſometimes ſeperates and makes openings between the parts of the plat, ſo that the cable may be chafed in theſe openings, which a leather ſervice is not ſubject to, being all the length of the hide in one piece. The method of putting it on the cable, is firſt to wrap two or three fold of old canvaſs, the length of the leather ſervice, which, if too ſtiff to put on dry, requires only dipping in water, and beating it againſt any wood, which makes it immediately ſoft and pliable; then let as many hands as can come at it, wrap it as tight as poſſible upon the old canvaſs, round the cable, tying it tight and ſmooth on with ſennit, or three yarn nittles, made for that purpoſe, greaſing them and the ſervice, very well, before veering it into the hauſe-hole.

I WOULD adviſe to avoid a practice I have ſeen uſed on this occaſion, that is taking a timber hitch with ſome nittles round the cable upon the canvaſs, then wrapping the leather ſervice and the nittles round the cable together, which raiſes the leather in the place of thoſe nittles where it will ſoon chafe through.

How the weakeſt Moorings may be beſt applied, to help a SHIP to ride out a Storm.

IN a dangerous ſituation, all practicable hints, that may contribute any thing towards ſafety, deſerve notice; and it may often happen that the ſmall bower cable may be too much worn, or the ſmall moorings known to be too weak to bear the ſtrain of the ſhip to ride out a ſtorm, when the anchor at the beſt cable is in danger, or expected to come home; in this caſe, I would recommend endeavouring to make the weak moorings ſerve for a backing to the beſt anchor and cable, contriving a traveller (as it may be properly called) of ſufficient rope, to go ſlack round the beſt cable, without the hauſe, and well ſecured with rolling hitches ſeized, &c. to the weak moorings that may be veered away, or let go as occaſion may require; or if ſhort of rope to make a proper traveller, a ſtopper may be put on without the hauſe, till the end of the ſmall moorings is put round the beſt cable, with a bowling knot open enough that it may ſlide along the beſt cable, till it comes to the anchor ſtock, which may prove ſuch a ſure backing

to

to it, as to prevent its coming farther home; ſo that by this means, there is a much better chance to ride out a ſtorm by the beſt cable, ſingly, than to run the riſk of either anchor coming home, to bring them both a head together, by which one cable is apt to get foul of the other anchor, and to get ſo entangled as to make the anchors come home, or make it neceſſary to cut the cable which is foul of the anchor, if the ſhip has a pitching motion.

BUT it muſt be allowed, that this, as well as every other uncommon method, requires judgment to contrive, and reſolution to put the deſign ſpeedily in practice, as the occaſion and neceſſity may require, to preſerve the whole when ſafety depends upon riding out a ſtorm.

ON UNMOORING A SHIP.

THERE needs little to be ſaid on this ſubject, if the ſhip lies in a clear, roomy place, as either anchor may then be taken up firſt, by veering to it, or may be weighed with a boat, &c. But if ſituated among a crowd of ſhips, or near the ſhore, then it requires to look about, and conſider well to take up that anchor firſt, that gives the cleareſt birth to caſt the ſhip, or get her underway in the moſt advantageous manner, clear of the dangers that may be near. For want of conduct on ſuch occaſions, I have known great damage done.

IT was ſaid by the celebrated Doctor Halley, that the Syſtem of Navigation in his time, depended upon three L's, meaning Lead, Latitude, and Look-out, each of which deſerves particular notice, as ſafety, no doubt, will always greatly depend upon them, I ſhall therefore notice them in their order.

ON HEAVING THE HAND-LEAD.

THIS method of ſounding the depth of water is peculiar to our ſeamen, and I judge had it's riſe in the coaſting trade to *London*, where their ſucceſs and ſafety depended greatly upon it; and ſo dexterous, by their great practice they become, that they will heave the lead far enough to reach the bottom, and give true

ſoundings

ſoundings in eleven or twelve fathom water, when the ſhip may be going at the rate of four or five knots through the water; and their rules being equal to their dexterity, deſerve mentioning, and ſhould in my opinion be followed as ſtandard rules for the hand lead, for want of which being properly uſed, I have known many misfortunes and fatal loſſes, which might have been avoided. I have heard of a commander of a large ſhip, in the above coal trade, who in dangerous places always hove the lead himſelf, and cunned, or ordered the ſhip about, according to the ſoundings, which he ſung, or ſpoke out aloud as the other men.

Rules commonly obſerved by a good Lead-Man.

WHEN ordered to the lead, he takes care, 1ſt. that the inward end of the line is made faſt, to prevent loſing it. 2d. That the lead and line may run clear, and come fair to hand, he takes them out before that ſhrowd next to his foremoſt hand where he ſtands to heave. 3d. The firſt caſt of the lead he only heaves out about ſix or ſeven fathom of line, which prevents the lead being over hove, and readily makes known that the ſhip is not in immediate danger, when no ground is found at that depth; and it is an eaſy way to clear the line for a deeper caſt the next heave, if the occaſion requires it. 4th. When ſounding in leſs than five fathom water, or when there happens a ſudden alteration of leſs water, he heaves the lead as faſt as poſſible, and ſpeaks out the ſoundings briſkly, with a loud voice, and does not ſing them out, which takes ſo much time that I have known a ſhip to come a ground before the ſounding was made known.

ON SINGING OUT THE SOUNDINGS.

THIS cuſtom is certainly a benefit to a fleet of ſhips, ſailing near together in difficult channels, where ſafety depends upon the lead, as in the coal trade to *London*, where I ſuppoſe the practice began, finding the advantage of hearing each others ſoundings as a guide to the whole.---Another advantage attending this practice, is, where a commander is not well acquainted, he may

may go off the deck, and look at the ſoundings laid down in the chart, or inſtructions for the place, and hearing the depth of water ſung at the ſame time, compare how they agree.

BUT it muſt be allowed that there are riſks attending this practice, by the lead's man ſtanding ſtill all the time he is ſinging out the ſoundings; for which reaſon the before mentioned 4th rule for a good lead's man, ſhould be ſtrictly obſerved, to avoid the danger there mentioned, to have happened whilſt the lead's man was ſinging out the ſoundings, with a long tone, thus, *by, the, mark, three,* &c. in which time the ſhip came a ground, which might have been avoided, had the ſoundings been ſpoke out quick, as above recommended. This makes me think, that it may be a diſputed point, whether the ſoundings may not be as well or better heard, when ſpoke out quick with a loud voice, than when they are ſlowly ſung out; if ſo, the advantage muſt be greatly in favour of ſpeaking out the ſoundings, on all occaſions.

ON SOUNDING WITH THE DEEP-SEA-LEAD.

I WOULD recommend, here, what I have found by experience to be an advantage, that is, having the lead only fifteen pounds weight, with a ſmaller line than common kept ready upon a reel, made large enough for the purpoſe, like a log reel, and hung up in beckets, where a man can readily take and hold it between his hands, on any ſudden occaſion: and that the lead may ſink the faſter, to have ſmall and few marks, as the hand lead and line will get ſoundings at any time, in ten fathom water; the deep-ſea-line need only to be marked from ten to ſeventeen fathom, as common, and from twenty upwards with knots as ſmall as thoſe in the log-line.

THIS lead requires various methods of heaving it, according to the depth of water expected, and the ſhip's head or lee way at the time the lead is to be hove. When a ſhip is ſailing right an end, without much lee way, if ſoundings cannot be got by heaving it from the cat head, or ſpritſail yard, a man muſt carry the bight of the line to the jibboom end, and with a tight line ſwing the lead forward, when another man gives it all the force he can from the ſpritſail yard. This method well managed, will heave the lead the

fartheſt it can be done, to get ſoundings, without bringing the ſhip to.

To bring a SHIP to, to Sound.

THE difficulty of getting true ſoundings, in a gale of wind, increaſes in proportion to the depth of water, and the violence of the wind and waves. The beſt method that I have experienced, is to paſs the lead from the weather quarter, round the ſtern to leeward, without all, to the fore part of the quarter deck and a man to carry the bight of the line to the lee main-yard-arm, which is to be laid ſquare when the helm is put a lee, to bring the ſhip to; and when the ſhip begins to ſhoot to windward by her headway, then the lead is to be ſwung right to leeward from the deck, whilſt the man at the yard-arm, with a tight line, ſwings it as far as poſſible to leeward of the ſhip, which gains to windward of the lead, whilſt the headway continues, and then runs her ſtern up to the wind by the ſternway, backs near to where the lead was hove, by which means, as mentioned in box-hauling, page 86, a great deal of line may be run out, nearly up and down; and the lead being armed with tallow, makes it certain whether it has ſtruck the bottom or no, and if it has, ſhews, what ſort of a bottom there is.

WHEN and how oft it may be neceſſary to try for ſoundings, muſt be left to the diſcretion of the commanding officer, and will be more or leſs ſo, according to the nature of the coaſt, place, or ſituation of the ſhip; but the want of it's being done in due time, is well known to have occaſioned many fatal loſſes. Therefore they who neglect heaving the lead, will always be blamed in proportion to the degree of danger, and the loſs their neglect may occaſion.

THE latitude when it can be got by a good obſervation, with a good inſtrument, muſt be allowed to be the only guide we have in navigation; becauſe it not only gives to a certainty, the ſhip's place, North and South, but it likewiſe helps us to form a judgment how far a dependence may be put on our reckoning, Eaſt or Weſt; in proportion as the latitude by the account kept of the ſhip's way, agrees or diſagrees with the latitude obſerved in the paſſage in general; ſo more or leſs dependence accordingly may be put upon the longitude the ſhip is reckoned to be in.

On the Latitude of Places being wrong laid down.

WHERE people are ſtrangers to places which they have not got laid down from good authority, in new charts or books of eſtabliſhed good character, but have them only in old books, or general charts on a ſmall ſcale, where the latitudes may be very erroneous, great caution ſhould be uſed to avoid the ill conſequences which may attend ſuch errors, when they may be drawing near to danger, or in making a land fall, &c.

I was in a ſhip bound from *Liſbon* to *Mazagan*, a *Portugueſe* garriſon on the coaſt of *South Barbary*, with which, in very fine weather and a fair wind, falling in as we thought by the latitude obſerved, we were in a fair way to find the place, the latitude of which we had only laid down in an old general chart, on a ſmall ſcale. Being all of us ſtrangers, we traced the coaſt cloſe along ſhore by day, and laid the ſhip to at night; thus we ſearched for the place ſo long in vain, that we deſpaired of finding it, therefore it was reſolved, if poſſible, to try to turn the ſhip to windward, againſt a current then running, and go to *Gibraltar* to get a pilot to find the place, when in our way back, we found it was a degree of latitude to the northward of where we had ever looked for it, owing to its being wrong laid down in the chart, and to our officers not getting every poſſible information, concerning a place with which we were not acquainted, before proceeding on the voyage.

BEFORE cloſing this ſubject, I cannot help acknowledging that great ſervice done to all ſeafaring men by Mr. HADLEY, in the invention of his excellent Quadrant, for obſerving the latitude in

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ſo eaſy and certain a manner, and which I can ſay from experience is moſt excellent, when compared to our old inſtruments, for that and the many other uſeful purpoſes it anſwers, in taking angles horizontally in ſurveying, and of the ſun and moon, or moon and ſtars, towards finding the longitude, and equal altitudes to find true time, &c.

ON LOOKING-OUT.

A GOOD lookout may juſtly be ſaid to contribute more than any thing towards ſafety, not only from ſhores or ſhoals, &c. but from ſhips running on board each other at ſea, which no doubt often has, and may prove fatal to thoſe who neglect it. Therefore the utmoſt care ſhould be taken, that this duty is not done in a careleſs manner; and the tranſgreſſors ſhould be puniſhed, by ſome means.

I was in a ſhip, in company with a fleet of ſhips of war, turning to windward in the night, with a freſh breeze of wind, when our mate of the watch, as walking the weather ſide of the quarter deck, was allarmed with hearing called out from another ſhip, "a "good lookout before there," and an anſwer made by ſeveral "aye, aye,"---the mate ran to leeward, looked under the mainſail, and ſaw a frigate on the other tack running on board of us; her jiboom ran within our lee mizen ſhrouds, and tore them all away; her ſheet anchor fluke took our main chain plates, tore them all away, and ploughed away the plank and timbers till it got clear through our ſhips ſide, before one ſhip ſtopt the others way, and they were ſo locked and entangled together, that had it been a rough inſtead of a ſmooth ſea, as it happened to be, one or both ſhips muſt have ſunk, before they got clear of each other.

THIS ſhews, notwithſtanding the ſtrict diſcipline uſed on board our King's ſhips, that this important duty is negligently done there, as well as in other ſhips, by careleſs men, not conſidering how much depends upon their lookingout, when ſkulking or diverting themſelves with ſtories upon the forecaſtle; they, without looking-out at all, will anſwer regularly to the word of command, "aye, aye," which occaſioned the above misfortune. For theſe reaſons, as long as the weather permits, the lookers-out ſtationed on deck, ſhould be made to walk each man by himſelf,

which will prevent them from being diverted, or ſleeping on this duty; for it is well known that a man may ſtand and ſleep, but he cannot walk and ſleep; and to make this duty both eaſy and well done, it ſhould be taken ſpell and ſpell, according to the number of the watch that can be truſted, and as circumſtances may require.

THE wideſt and cleareſt part of the ocean muſt be allowed to require a lookout; for any two ſhips that are croſſing each others track, may meet and deſtroy both; and the worſe weather, the more occaſion there muſt be for caution. As I was croſſing the weſtern ocean, where we had a very narrow eſcape, ſailing with a gale of wind, quartering under mainſail and foreſail, when the lookers-out upon the forecaſtle, ſeeing a light right a head, took it for, and ſaid one to the other, it is a ſtar, for which it paſſed till we came ſo near, before it was perceived to be a ſhip lying to with a light out, that we ouly juſt got clear of her ſtern, by putting our helm hard a port, which but juſt ſaved both ſhips from immediate deſtruction.

To prevent being deceived on this occaſion, I think it neceſſary here to remark, that when any light appears in the horizon, or near the water's edge, it cannot be a ſtar, for the atmoſphere or air ſo obſcures the ſtars, that they cannot be ſeen to riſe or ſet in the horizon. When drawing near to any danger, where ſafety may depend entirely on a good lookout, if the weather permits, and the ſhip is manageable, and will work under her topſails, with the mainſail and foreſail in the brails, it gives a fair opening for the officer, as well as others upon deck, to look round them, to ſee any dangers which may appear. The little difference thus made in the ſhip's ſailing, is not to be compared with the advantage given for ſafety, or preventing damage on ſuch occaſions,

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ON LOOKING-OUT FOR LAND.

IT is found to be neceſſary in foreign voyages, to propoſe a reward for the man that firſt ſees and calls out land, if it proves to be really ſuch; and if it be not ſuch, I think it is a bad cuſtom to abuſe him, if he happens to give a falſe alarm, by miſtaking a cloud for land; becauſe it is well-known, that the land ſometimes appears ſo much like a cloud, or a cloud ſo much like land, at a diſtance,

diſtance, or the land may be covered by a cloud, that often makes it difficult to diſtinguiſh one from the other. For which reaſon a man ſhould not be made a ſufferer for a miſtake of this kind, but ſhould be encouraged, and have liberty to call out from the maſt head that there is ſomething like land appears; this might prevent the bad conſequences that ſometimes happen, from people being afraid to ſpeak in good time, for fear of being miſtaken, and meeting with diſcouragement.

On Looking-out aloft for SHOALS, &c.

THIS duty well done, may prevent a ſhip coming aground; therefore the looker-out at the maſt head, on this occaſion, ſhould be encouraged, and ſtrongly recommended to make known without fear or reſerve, all alterations or different appearances of the water; a ſeeming change of colour ſhould not be omitted, though it may often proceed from the reflection of clouds, yet it may prove ſhoal water, and neglect may be fatal; for which reaſon an officer ſhould always take the trouble to go up to look at what is noticed from the maſt head, on all occaſions; and riplings, broken water, or the appearing of an extraordinary ſmooth water, when the ſea is rough, ſhould all be ſtrictly noticed, as they may prove to be great dangers.

By want of attending to this ſmoothneſs on the water, from the maſt head, I had a very narrow eſcape from running the ſhip on ſhore, in turning to windward through the *Gulph of Florida*, when ſtanding towards the *Colleradoes* with a deſign to make as bold with them as poſſible, in order to a longer ſtretch on the other tack. I ordered the man at the maſthead to lookout ſharp for broken water, which we expected to ſee at a ſufficient diſtance; but inſtead of meeting with breakers, we fell into an axtraordinary ſmooth water, all at once, which was taken no notice of from the maſthead; we tacked in a great hurry, and had but four fathom water when the ſhip was got about, and was but juſt clear of the ground.

IN thoſe ſeas where the water is very clear, and the weather fine, frequently from the maſthead may be ſeen ſhoals that the ſhip might touch upon; and eſpecially if the ſun ſhines a ſtern, or is abaft the beam when the ſhip goes her courſe. This enlightens and makes more viſible the parts of the ſhoals towards the ſhip, ſo that from the maſthead, I had the experience of cunning a ſhip in the beſt of the deep, clear of dangerous ſhoals, through channels where we were not acquainted; but a rough ſea, or the ſun happening to ſhine a head of the ſhip the way ſhe is going, hinders the ſhoals being ſeen under water, though it may be clear and ſmooth. I had this laſt caſe confirmed, by an inſtance in lookingout for ſhoals, called the *Silver Key* or *Plate Rocks*, lying off the N. E. part of *Hiſpaniola*; the ſun happened to ſhine a head of the ſhip, when a part of the ſhoals we had paſſed were ſeen a ſtern, from the quarter deck, before any was ſeen from the maſthead. I was very angry with the man lookingout, till I was convinced he was not in fault; for nothing could be ſeen under water a head, the way he was ordered to lookout, owing to the dark or ſhaded parts of the ſhoals being towards the ſhip, and the water reflecting the ſun's rays upon the eyes of the looker out, that prevented us from ſeeing the dangers. I ordered the helm a weather, and brought the ſun aft, and cunned the ſhip out again clear of the ſhoals, which we could ſee very plain with the ſun a ſtern; they ſeemed to be coral rocks, here and there one, in a ſtraggling manner, with about four fathom water upon them that we paſſed. But it muſt be allowed that theſe ſhoals, ſeen in an oblique direction, appear much ſhoaler than they really are, by the refraction of the water being ſo much greater than that of the air; as is well known from that common experiment of a ſhilling that cannot be ſeen obliquely over the edge of a bowl, till water is poured upon it, which cauſes it to appear viſibly higher to the ſight. It is the ſame with theſe ſhoals, when obliged to go right over them, if the ſhip has water enough, they are ſeen and found by the lead to lie deeper than was expected.

The ſun ſhining a head hinders ſhoals being ſeen that way.

I VENTURE, ſailor like, to make ſome remarks on this fourth L, the diſcovery of which hath been long expected, and is ſtill laudably purſued and encouraged by all the learned nations of the world.

THE great rewards offered, and the encouragement given by our government, has occaſioned many methods to be tried for this uſeful diſcovery; Mr. IRWIN's Marine Chair, to obſerve by Jupiter's moons at ſea, to which a fair trial has been given; Mr. HARRISON's famous Time Piece, which performed ſo well in the voyage of trial to the *Weſt Indies*, as to gain £. 10,000 reward; and now what is recommended and publiſhed by order of the Board of Longitude, MAYER's Tables, and MASKALINE's Nautical Almanack, to obſerve and calculate by the ſun, moon, and ſtars, which I doubt will require too nice obſervations, and too long calculations, to be performed without errors, by the generality of ſuch ſeamen as at this time navigate ſhips at ſea, who will think it too difficult to come near true time of day or night, on this uncertain element; and every minute they are out in that, makes an error of a quarter degree of longitude.

THEREFORE without this much laboured for diſcovery, can be brought within the reach of common capacities and learning to perform it with ſome certainty, without being liable to many errors, which every man is ſubject to in nice obſervations and long calculations among a multitude of figures, it may be productive of effects contrary to the deſign; eſpecially by putting people off their guard, and giving too much confidence to the vain and poſitive part of men, who cannot bear to be thought wrong in their reckoning. Many inſtances I could give of this diſpoſition, but ſhall only mention one, who, though he was ſteering an eaſterly courſe in the night, and was told that land was ſeen a head, replied, "that the devil muſt bring it there if there was any, which he could not believe."---The conſequences of this obſtinacy, was the loſs of a fine large ſhip and a rich cargo.

THE Board of Longitude, in order to facilitate the diſcovery that is expected to be made by this laſt mentioned method, has ordered, that the maſters for the royal navy muſt qualify themſelves, by learning to paſs an examination to ſhew that they underſtand the Nautical Almanack, which is a taſk, in my opinion, that cannot be expected from many of our moſt hardy and expert navigators, whoſe education has been moſtly from early youth through the hard, laborious, and buſy ſcenes of life at ſea, and who have never

Except the Longitude can be come at by a certain *eaſy* method, it may do more harm than

good among the vain poſitive part of men.

never had the opportunity, to get the learning that is neceſſary, to underſtand the true principles of this Almanack.

ON this occaſion, with humble ſubmiſſion to the learned, I ſpeak for myſelf and many maſters of ſhips, who can conduct a ſhip to any part of the world, that hath its latitude and longitude right laid down, without having learned ſo much aſtronomy at ſchool, as to underſtand the characters, ſigns and terms, &c. that are uſed in thoſe Almanacks, to diſcribe our ſyſtem or ſet of worlds, with their moons and their motions round the ſun; which terms, &c. are in an unknown tongue to one who is but a mere engliſh reader: and our world and moon, with their motions and places, are there ſet forth in a complex myſterious manner, telling us every day where the ſun is in the ecliptick, where no ſtar is to be ſeen at that time, which makes us ſo little acquainted with the fixed ſtars, as to think that they and the ſun, according to the old notion, go round us every day, as they appear to do by our world's daily, motion. It is from our knowledge of the fixed ſtars, that lie near the moon's path, that the obſervations for this diſcovery are to be principally made, which ſhews the great neceſſity, not only on this account, but for many other benefits to ſeamen, for us to endeavour to get the courſe, motion, and place of our world and moon, deſcribed and repreſented in ſuch a plain manner, that ſuch navigators, as above mentioned, may form ſome notion how we and the other worlds, called planets, that belong to our ſyſtem, are conſtantly changing places, each in their different orbits, or paths; and going faſter or ſlower according to their diſtance, round the ſun once in the year, in wonderful order, from the fixed ſtars in one part of the firmament, round to the ſame ſtars again, according to the laws given them by the Almighty Creator and conductor of the univerſe, as is illuſtrated, and in a particular maſterly manner ſhewn in FERGUSON's Aſtronomy, where the names of the twelve ſigns in the Zodiac, and the reſt of the conſtellations are in engliſh, whereby the fixed ſtars are to be known. But the moſt fruithful imagination cannot find the leaſt reſemblance of thoſe figures they are commonly called by, and which require a great while to learn; ſo that notwithſtanding the pains taken by this extraordinary ſelf-taught Philoſopher, to whom I acknowledge myſelf under the greateſt obligations, as what little I have learned in that ſcience is from him,* yet I cannot help thinking, that this ancient

To have our ſuns ſyſtem of worlds and the fixed ſtars more eaſily deſcribed to ſeamen.

* The friendſhip Mr. FERGUSON favoured the author with, and the advantages he derived from thence, call for every acknowledgment on his part; but to attempt to beſtow on that excellent

ancient method of teaching the motion of our ſyſtem, is perplexing, and is a burden to the memory, for the reaſons given above; and that it might be much better and eaſier taught to ſeamen, by the form of the card of the Mariner s compaſs.

A compaſs card ecliptic recommended inſtead of the twelve ſigns.

IT muſt be allowed that we excel the ancients greatly in ſhipping, and navigating them, ſince time has diſcovered and brought into uſe, that noble inſtrument the Mariner's compaſs, by which a ſeaman knows how to ſteer a ſhip, and to calculate the ſhip's way. He muſt underſtand how to quarter and divide this compaſs into the 360 degrees, which, extended out in ſtraight lines from the ſun's center, might repreſent the 360 degrees of the ecliptic, in a much more familiar manner to ſeamen in general than the twelve ſigns, Therefore to anſwer this good purpoſe, I would recommend to thoſe in power, to get a ſet of large plates engraved, ſuch as are uſed now to ſtamp handkerchiefs with; the firſt to repreſent our ſolar ſyſtem as it really is, with the ſun in the center and its rays to form the ſea compaſs card, with the 360 degrees extending outwards, through a large circle divided into the months and days of our year; the North point pointing to the 21ſt of December, which may properly be underſtood to be the northermoſt part of the worlds orbit, as we then enter into what is now the northermoſt conſtellation in the ecliptic, called Gemini, which makes our ſhorteſt day, when at the ſame time the South latitudes have their longeſt day; the reaſons for it, and the other ſeaſons of our year will appear evident, by having our world delineated on the eight capital points of this compaſs ecliptic, N. N-W. W. S-W. &c. round the ſun, as Mr. FERGUSON has done in his 5th plate of Aſtronomy, from which, and a ſcheme he drew for me to make obſervations on the tides, I formed this deſign of what I call the ſeamen's ſyſtem, and had one drawn and put upon a wheel work planitarian, to obſerve whether our neighbouring worlds

cellent and ſurprizing character, but a part of the praiſe juſtly due to him, greatly exceeds the writer's power. Mr. F. was really a ſelf-taught, or rather heaven-taught, philoſopher, who with no other advantages than half a year's common ſchooling, and during the purſuit of a mechanical profeſſion neceſſary for the ſupport of himſelf and family, acquired a degree of knowledge in aſtronomy and experimental Philoſophy, which, his Sovereign, and the Royal Society, unſolicited, thought it but juſt to diſtinguiſh with rewards and honours.

After a life of uſeful labours, imbittered by domeſtic unhappineſs, and a feeble and precarious ſtate of health, (to uſe the words of a friend of his here,) "worn out with ſtudy, age, and "infirmities, he was at length permitted to attain that heaven, on which his thoughts and "views had long been fix'd, and which is the ultimate reward of learning, virtue, patience, "and piety." *(See in Dodſley's Ann. Regiſter, 1776; Some account of the late celebrated Mr.* FERGUSON, *by* Dr. HOULSTON.

paſſing near us in their orbits, had any influence on the tides, but found none.

THUS by having our globe repreſented in different parts of the orbit which it moves in, at the rate of near one of the 360 degrees of the ecliptic every day, and in that time turns once round on the center of its daily motion, which is at the poles which lie in a direction of $23\frac{1}{2}$ degrees, inclinable towards the plane of its orbit, and the year round always keep pointing towards the ſame part of the ſtarry firmament, as is evident to any common obſerver, who may ſee our North pole always points towards what we call the North pole ſtar, that never goes below our horizon in North latitudes, by a little thinking, it may be perceived in general, how our nights and days with their alterations, and the ſun's declination, are brought yearly about, by the ſun always enlightning that half part of our globe that is turned directly towards it; and as it is on the 21ſt of December when our globe is on the the North point of the ecliptic, when I would have the year for this ſyſtem to begin, when the ſun ſhines directly upon the South tropic, its light reaches 90 degrees round on our globe, takes in all the South polar circle where it is all day, by its then pointing moſt towards the ſun: it is then all night in the North polar circle, becauſe it points moſt from the ſun, as repreſented in the figure on the North point of the ecliptic.

BUT comparing ſmall things that can be ſeen, often helps us to form an idea of what is too big for our ſenſes to diſcern; a bomb ſhell of twelve inches diameter, forced into motion through our air, may be ſeen by its fuſe to keep turning round and round on its center of gravity, as it moves forward; ſo our globe, in round numbers about 8000 miles diameter, inſenſibly to us, moves forward in her orbit, as may be ſuppoſed, at the rate about 1000 miles in every minute of time, whilſt it is known to keep regularly turning on the center of its poles a quarter degree of longitude, which makes fifteen degrees for every hour of time, that brings about midday and midnight to all the different parts of our globe, between the polar circles in twentyfour hours, as they are repreſented by the twentyfour meridians in the figures, which all center, or croſs each other, at the poles, dividing our globe into the 360 degrees of longitude, Eaſt and Weſt, as well as meaſuring the degrees of latitude, North and South.

THE

THE daily and yearly motions of our ſyſtem of worlds, with their moons round them are all one way, that is from Weſt Southerly about to Eaſt, and from Eaſt Northerly about to Weſt again, what we ſeamen underſtand and call againſt the ſun, or its apparent motion, as our globe is repreſcnted when it paſſes the North point of the ecliptic, and goes through our winter N. W. quarter, from N. to W. in its orbit, which brings our North polar circle more and more out of the dark into the light, and leſſens the ſun's South declination every day, till it comes to nothing on or about the 20th of March, when we are upon the Weſt point of the ecliptic, and the center of our daily motion is then broadſide to the ſun, which ſhines right upon our equinoctial line, and reaching both poles makes equal day and night, to all the inabitable part of the Globe, when the ſun riſes and ſets on the true Eaſt and Weſt points of the compaſs, without variation, and at the 6th hour in the morning and evening of that day.

How our ſyſtem of worlds with their moons move round the ſun. On our four ſeaſons. The winter quarter.

WE then enter into our ſpring, and S-W. quarter of the ecliptic, and move forward every day as above mentioned, from the Weſt to the South point of our orbit, as may be ſeen by the ſcheme how our North latitude days lengthen, and the ſun's North declination increaſes to $23\frac{1}{2}$ degrees on or about the 21ſt of June, when the ſun ſhines right upon the North tropic, and reaches over all our North polar circle, which then points moſt towards the ſun, when the South polar circle points the moſt from it that it can do the year round, as repreſented by the figure on the South point of the ecliptic.

The ſpring quarter.

WE next go through our ſummer S. E. quarter of our orbit, from the South to the Eaſt point of the ecliptic on or about the 22d of September, when we are again broadſide, in the center of our daily motion to the ſun, which then ſhines directly upon our equinoctial line, and reaches both poles, riſing and ſeting on the true Eaſt and Weſt points of the compaſs, and at the 6th hour morning and evening, the ſame as when we are on the Weſt point of the ecliptic on the 20th of March.

The ſummer quarter.

To complete the year, we go through our fall or N-E. quarter of our orbit, from the Eaſt to the North point of the ecliptic, which every day brings the South pole more into the light for its half years day; and the North pole goes as much into the dark for its half years night, until the 21ſt of December, when we are upon the North point of the ecliptic again; and the ſun having its greateſt South declination, ſhines right upon the South tropic then

The fall, or harveſt quarter.

What occaſions the half years day and night at the poles.

pointing $23\frac{1}{2}$ degrees towards the ſun, when the North pole points as much from the ſun, which is then true South from us, at noon by the compaſs as we are true North from it, which may be perceived by the meridian pointing right to it. And on the 20th of March, when we are on the Weſt point of the ecliptic, the riſing ſun bears true Eaſt by the compaſs. And on the 21ſt of June, when we are on the South point of the ecliptic, our North pole then points $23\frac{1}{2}$ degrees towards the ſun, which (from between the tropics) is, as it bears by the compaſs, true North from us, as may be obſerved by the noon meridian pointing ſtraight to it. And on the 21ſt of September, when we are on the Eaſt point of the ecliptic, the ſetting ſun then bears true Weſt by the compaſs, from us, as we are true Eaſt from it. And theſe four compaſs quarters of our orbit, whereby our four ſeaſons and quarters of the year are diſtinguiſhed, contain 90 degrees of the compaſs ecliptic; which drawn out to the extent of a large handkerchief, will give room for all that is neceſſary to anſwer this purpoſe. Our moon with a different face in her orbit, may be put to each figure of our globe and Jupiter's moons, as Mr. FERGUSON has ingeniouſly done in his 5th plate of aſtronomy, might ſhew how they may be obſerved, going into and coming out of Jupiter's ſhadow, from our different meridians, in the different parts of our orbit. And without Saturn's orbit, may be placed the ſtars to the fourth magnitude of the twelve ſigns of the Zodiac, as the before mentioned neceſſary obſervations for the longitude are to be made.

At the begining of the four ſeaſons, when we may ſee the ſun and we bear true N. and S. E. and W. of each other by the compaſs.

Eight different places and faces of our moons and jupiter with his moons in miniature to be added to the ſcheme.

The Almanacks to give our worlds place at midnignt in the degrees of the compaſs ecliptic.

BY this ſcheme, and as the almanacks give the ſun's place every day at noon, to ſhew our world's place at midnight, in degrees of the compaſs ecliptic, which in this ſcheme goes through the days of the month and which will point out very plain, what ſtars of the ecliptic will be brought upon, or neareſt to the meridian every midnight in the year; we might ſoon become ſo far acquainted with them, as to know all the principal ſtars of the twelve ſigns, many of which are always viſible in clear nights, where we navigate; ſo that on many important occaſions, excluſive of the longitude, to know them as they appear would be of the greateſt ſervice to ſeamen, and more eſpecially to the thinking part of navigators who never learned aſtronomy. They may hereby form a notion how we are ſituated and move, in our daily and yearly motions round the ſun, conjectured to be from us the diſtance of about one hundred milions of miles, among the other worlds that belong to our ſyſtem; and alſo how obſervations for the longitude

To try to obſerve Jupiter's moons at ſea with Dolland's

may

may be made by Jupiter's moons as above mentioned, to get the difference of time from *Greenwich*, as given in the almanacks allowing four minutes of time for every degree, which will give the longitude in East and West; and by comparing DOLLAND's improved spying glass with the reflecting telescope. I cannot help thinking, that the weather may often permit these observations to be made at sea, with DOLLAND's best glasses, which certainly deserve a fair trial, as it is well known, some officers are by practice so expert with them, that they can stand upon their sea-legs, as it is called, and balance themselves in a surprizing manner, so as, in some measure to counter-act the ship's waving motion, when they are using the spying glass, or taking observations so that by practice it is to be hoped, these observations will become of great use, at least in smooth water. And as we pass Jupiter in his orbit, once nearly every year, it should be noticed, as represented in the scheme, that when we are coming up with Jupiter, to observe his moons going into his shadow, and when we have past him, to observe them coming out of it; and that their motion round him is the same as our moon round us, against the sun, from the right hand to the left.

improved spyglasses recommended.

I WOULD further recommend to those in power, to have two more large plates engraved and made public, with the West and East hemispheres of the fixed stars, as represented on the best celestial globes; the first plate to begin and continue the degrees of the equator and the ecliptic, according to the yearly course of our globe, from our winter to our summer solstice; and the second plate from our summer to our winter solstice again, and to have the days of the year added to the degrees of the equator; the meridians of which will point out our situation, to know what principal stars will be visible, and come upon, or near the meridian, every midnight in the year; and to have them named, marked, or numbered, so as to be better known to an english reader, than by the hard names and characters they now bear. And as the equator crosses the ecliptic that extends to the opposite sides of the North and South tropicks, and the poles of the ecliptic to the opposite sides of the polar circles in each of these spheres, it would shew by inspection, from the days of the month at the equator, the declination of the stars, that lie in the plain of the ecliptic the year round, occasioned by the obliquity of our world's motion to the plain of the ecliptic, as before mentioned.

To have two large star hemispheres made public.

I AM

I AM ſo well perſuaded that theſe three ſchemes thus made public on handkerchiefs, executed by maſterly hands would be frequently of eſſential ſervice to many ſeafaring men, who without any advantages of education or any conſiderable previous knowledge of the ſubject, are given to obſervation and deſirous of information, that I got them all drawn by a ſelf-taught philoſopher, but I reckon them ſo inferior in compariſon with ſuch as the board of Longitude, for inſtance, could point out and get executed, (and that at no great expence,) that I complied with the opinion of my friends in not adding them to this volume, the price of which they muſt have enhanced, nor would they have been within the compaſs of every body's pocket, nor have fallen into nearly as many hands as the propoſed handkerchiefs, which, if common amongſt ſeamen, in my opinion, would induce the inquiſitive part of them, who are ſo much on duty upon deck in the night, to employ their vacant time in comparing theſe repreſentations, and what has been ſaid on the occaſion, to what may be obſerved and learned from the grand ſyſtem of created nature, and the general laws given to our ſun's ſyſtem of world's; and contribute to make them, and the principal fixed ſtars more eaſily and generally known by inſpections; that uninformed people, by land as well as by ſea, might learn often to find guides in clear weather, when at a loſs to find their way in diſtreſſed ſituations; eſpecially ſeamen, when by accident, or misfortune, deprived of the compaſs, at a great diſtance from a land of ſafety, which they may be forced to attempt to reach in ſmall boats;---as well as many pilots and fiſhermen, who go to ſea in ſuch ſmall boats, that a ſea compaſs will not ſtand ſteady enough to point out the courſe they intended to return by, when driven of their coaſt by ſtorms.

SUCH a general knowledge as might be derived from hence almoſt by any ſeaman who can read, might frequently prove of the moſt beneficial conſequence in caſual ſituations of diſtreſs, like thoſe juſt mentioned, which are ſufficient often to diſcompoſe even learned men, and to deprive them for a time of the uſe of their abilities and preſence of mind. But in order to remove the difficulty to ignorant people, ariſing from the hard greek names given to the ſtars and conſtellations, it would certainly be ſerviceable to add to ſome of the more conſiderable and material of them, a familiar name by which they might be known, and which might bear ſome relation, or reſemblance, to the apparent figure of them. Thus for example, inſtead of calling thoſe which point to the North

North Pole ſtar, the Great Bear, *of which no form or likeneſs whatever can be traced*, I would call them the Plough, to which I think they bear a much greater reſemblance, therefore they may be much better, known to point out the North Pole ſtar, which lies near in a ſtraight direction with the poles which our world turns upon in its daily motion, and where all our true meridian lines meet in a point, which makes the plough pointers, as I call them, whenever they appear plain above, below, or oblique always to point to it; and in coming home from *India* I have obſerved the plough, when above the Pole ſtar, with great pleaſure in upwards of twenty degrees ſouth latitude, and when we came to four degrees north latitude in clear nights, the north pole ſtar appears about four degrees above the horizon, which makes theſe ſtars the moſt extenſive and advantageous guides on diſtreſſed occaſions of this kind; for it may be eaſily conceived in clear nights when theſe ſtars can be ſeen, how to get either by ſailing or rowing on, or near any of the eight capital points of the compaſs without variation, for keeping the pole ſtar, or its place, ſame right a head, or a ſtern, goes true N. and S. and on the larboard and ſtarboard beam E. and W. and each of theſe blows N-E. and N-W. and each of theſe quarters S-E. and S-W. And as the ſtars of the ecliptic, in clear nights, may be ſeen to the whole extent of the inhabited parts of the world, if familiar names were given to them (ſuch as the yard wand for Oririons belt,) and the midnight marked down on which they were to paſs near the meridian, that the moon, with their riſing and ſetting, would certainly afford great help by night, and the glorious luminary, the Sun, by day, when it can be ſeen, needs not to be mentioned, which, no doubt, were all the guides that the famous ancients travelled and navigated by before the wonderful beneficial inſtrument the ſea compaſs was diſcovered.

I SHALL juſt remark before I conclude this ſubject of finding the way, when deprived of the ineſtimable providential advantages of the ſea compaſs, that, when likely, by cloudy and thick weather, to loſe ſight of the Sun, Moon and Stars, as was the caſe for fourteen days in St. Paul's voyage to Rome, and having no other view of a guide, to obſerve upon what part of the body, or of the veſſel the wind blows, and it may be kept upon the ſame point; but when it is thought to be altered, and it is not known how much, and to what point, then, if it can be done with ſafety, it is but prudent to ſtop, or lie to till ſome guide can be diſcovered.

THE

THE late diſcovery of a new Planet, to which, (in honour of our moſt gracious Sovereign, who has eminently diſtinguiſhed himſelf by his attention to improve nautical and aſtronomical ſcience,) the name of the Georgium Sidus has been given, by our great Aſtronomer Mr. Herſchel, who hath brought to our knowledge another world belonging to our Syſtem, which, no doubt, like our other worlds, is wonderfully conſtructed, and myſteriouſly conducted and kept in exact order; each of them revolving regularly in their hourly, daily, and yearly motions, with their neceſſary moons attending them, in their different and vaſtly diſtant ecliptical orbits, clear of each other, round our ſun; which motions produce days, nights, and different ſeaſons, as before obſerved, for the production in the vegetable and animal creation, of thoſe admirable properties, which we experience in this our world, for the benefit of the multitude of inhabitants, thereof, and principally for the ſupport, uſe, and convenience of man.

" Theſe Works are all of matchleſs Fame,
" And univerſal Glory claim;
" By thoſe who ſeek for them aright,
" And in the pious Search delight;
" And to poſterity record,
" That Good and Gracious is our LORD.

IT appears not improbable, but that the knowledge of the new diſcoveries, and the extenſion of nautical ſcience, may be much promoted, by the various late inſtitutions for that purpoſe, as the Marine School at Chelſea, &c. and the plan propoſed, (if duly carried into execution,) of having on board each of our channel cruiſers, an old officer, employed to act as a ſchool-maſter, and promote the information of the young perſons on board, deſirous of being inſtructed experimentally in the nature of a profeſſion, in which knowledge and aſſiduity give dexterity and excellence, and in which, their duty, their intereſt, their honour, and their ſafety, ſhould at once induce them to endeavour to excel.

BUT I think nothing would contribute ſo much to this important purpoſe, as having Maritime Schools in proper places at our ſea ports, where the moſt dexterous, real Practical Seamanſhip is required, and may be eaſily ſeen in narrow waters, by the ſcholars who are deſigned for ſea officers and pilots, which I have been long in purſuit of, and ſhall endeavour to deſcribe hereafter.

FROM

FROM all that I have ſeen, the ſeamen in the *Eaſt India* trade are the moſt perfect in the open ſeas, and thoſe in the coal trade to *London* the moſt perfect in difficult narrow channels, and tide ways, where, as they ſail by the voyage, it makes it their intereſt to be as dexterous and expeditious as poſſible in working and managing their ſhips, which in general are of 400, or 500 tons. This trade is hence rendered the beſt nurſery in the world for hardy, active, and expert ſeamen, and as moſt ſhips muſt be conducted through channels, or narrow waters, in their way to ſea, I will endeavour to remark what I think deſerves notice in making paſſages in the coal trade.

ON MAKING PASSAGES IN THE COAL TRADE.

IN the navigation from *Newcaſtle* to *London*, two thirds of the way is amongſt dangerous ſhoals, and intricate channels, (as may be ſeen by the chart of the coaſt,) and the ſhips are as large as the ſhoal channels will admit them to get through with the flow of the tide, which requires to be known to a great exactneſs to proceed in proper time, and dexterous pilots to navigate through thoſe channels with ſafety and expedition, to make ſo many voyages in the year, that they may be gainers by their ſhips, which are numerous as well as large, and managed by the feweſt men and in a more compleat manner than in any other trade that I know of in the world, conſidering the difficulty of the navigation, and how deep the ſhips are loaded, and how lightly they are ballaſted, yet they meet with very few loſſes in proportion to the number of ſhips, which the owners generally run the riſque of, and thereby ſave the expence of inſurance, by which means they can afford to freight their ſhips cheaper than others, ſo that they are become the chief carriers in the timber, iron, hemp, and flax trades.

BLOWING weather and contrary winds, often collect a great many of theſe colliers together, ſo that they ſail in great fleets, ſtriving with the utmoſt dexterity, diligence and care, againſt each other, to get firſt to market with their coals, or for their turn to load at *Newcaſtle*, where at the firſt of a Weſterly wind, after a long Eaſterly one, there are ſometimes 200 or 300 ſhips turning to windward in, and ſailing out of that harbour in one tide. The

ſight of ſo many ſhips, paſſing and croſſing each other in ſo little time and room, by their dexterous management, is ſaid to have made a travelling French Gentleman of rank, to hold up his hands and exclaim, "that it was there France was conquered;" the entrance into the harbour being very narrow, with dangerous rocks on one ſide, and a ſteep ſand bank on the other, with a hard ſhoal bar a-croſs, where the waves of the ſea frequently run very high, and put them under the neceſſity of being very briſk and dexterous.

THEIR management is moſt worthy remarking here; when they are going out with a fair wind in their great deep loaded ſhips, and the waves running high upon the bar, ſo that they would make the ſhip to ſtrike upon it, if ſhe was to ſail out, pitching againſt the head waves, to prevent which when they come to the bar, they in a very maſterly manner bring the ſhip to, and ſhe drives over, rolling broad ſide to the waves, which preſerves her from ſtriking.

A ſhip got to ſea by driving ſtern foremoſt with the tide.

I HAVE heard of a bold ſingle adventurer getting to ſea out of this harbour, when many ſhips lay windbound with the wind and waves right in, and right upon the ſhore without the harbour; he having a ſmall handy ſhip, and no doubt, materials and men that could be depended upon, made every thing ſnug and ready, as the occaſion required, and got as near the bar as ſhe could ride with ſafety, and had the ſails, that were deſigned to be carried, furled with rope yarns that would eaſily break; he then took the advantage as may be ſuppoſed, of the firſt of the ebb of a high ſtrong ſpring tide when there was water enough, and ſo drove over the bar, ſtern foremoſt, with the ſails all furled and the yards braced ſharp up, (as mentioned page 88,) by the ſtrength of the tide out of the harbour, 'till they reached the ſea tide from the ſouthward along the coaſt, then put the helm hard a ſtarboard, and brought the ſhip by the wind on the larboard tack, and expeditiouſly ſet all the ſails they could carry; the tide checking the ſhip two points on the lee bow, helped her to get to windward off the lee ſhore, ſo that they made their courſe good along the coaſt, and got their paſſage.

WHEN it happens that a great fleet of loaded ſhips ſails out in one tide, with the firſt of a weſterly wind, thoſe that draw the leaſt water take the advantage and get over the bar firſt to ſea, where they ſtrive and carry all the ſail poſſible to get and keep a head of each other, and the faſteſt ſailing and beſt managed ſhips commonly get the advantage whilſt they are in the open and clear

part

part of the ſea, till they come to work out of *Yarmouth roads*, where for want of water the ſhips of the greateſt draft are often obliged to ſtay for the flowing of the tide, and each ſhip is glad to follow another, which they know draws more water than themſelves when going through dangerous channels; this collects many of them near together again for their mutual ſafety, each heaves the lead and makes known aloud the ſoundings which often proves the principal guide to the whole fleet, as by that they find and keep the beſt of the deep in the intricate channels they paſs through and in which they often have a great deal of turning to windward againſt ſtrong weſterly winds. When they are obliged to ſtop the lee tide, they do it with the beſt bower anchor and cable to the better end, which makes them ſo expert in heaving up their anchors, and getting underway, as well as working their ſhips to windward (as particularly deſcribed page 83) and eſpecially up the *Swin* channel, in weather in which they would not venture to proceed with a fair wind. This ſeems a paradox to many people, therefore it may be of ſervice to explain their ſingular conduct on this occaſion.

Why they chooſe a turning, wind, rather than a fair one for ſafety.

WHEN they turn to windward up the *Swin* in dark hazy weather, they know by their ſoundings when they are in a fair way, and what ſide of the channel they are on, and by ſtanding quite a croſs the main channel from ſide to ſide avoid the danger of being hooked in, on the wrong ſide of ſpits of ſand in ſwatches where the tide runs through, and where there is the ſame ſoundings at the entrance as in the right channel, which is the reaſon that with a fair wind and hazy weather, a compaſs courſe is not to be relied upon, therefore each ſhip, very artfully, endeavours to get a leader that they know draws more water than themſelves, and the leading ſhip knowing their danger running no farther than they think it ſafe, commonly lets go her anchor, the next following ſhip apprehending the ſame danger, has her anchor ready and lets it go juſt above the firſt ſhip, and the next ſteers cloſe paſt theſe two ſhips and comes to an anchor juſt above them, and ſo on with the next, till the whole fleet forms a line one above the other, ſo that the ſhip that was firſt, becomes laſt, when they commonly again heave up her anchor, and ſteer cloſe by the whole fleet if they are perceived to ride a float and the next ſhip follows them, and either comes to an anchor again above the uppermoſt ſhip as before or proceeds forward, according as they find by the ſoundings, by which they know that they have paſt the dangers they

How they ſteer by one another in hazy weather.

were afraid of and got into a ſafe track, where they can depend upon the compaſs courſe, then they ſet and carry all the ſail poſſible to get or keep a head of each other.

Their dexterous management in London river.

THEIR management in working theſe large ſhips to windward, up moſt parts of *London* river with their mainſails ſet, is likewiſe remarkable, and, from their great practice, knowing the depth of water according to the time of tide, and how much the ſhip will ſhoot a head in ſtays, they ſtand upon each tack to the greateſt nicety cloſe from ſide to ſide as far as poſſible things will admit of to keep in a fair way, and where eddies occaſion the true tide to run very narrow, or ſhips, &c. lie in the way ſo as not to give room to turn to windward, they very dexterouſly brail up mainſail and foreſail, and drive to windward with the tide under their topſails by ſuch rules as have been deſcribed; and in the pool where there is ſo little room to paſs through ſuch crowds of ſhips, their management has afforded me the greateſt pleaſure, to ſee when they get near their deſigned birth, to what a nicety they let go their anchor, veer out the cable to run freely as occaſion may require, ſo as to bring the ſhip up exactly in time, in ſurprizing little room, clear of the other ſhips, and lay her eaſily and fairly along ſide of the tier of ſhips where they moor, ſo that, as they ſay, they can work and lay their ſhips to a boats length occaſionally. And their is no doubt but that to ſhorten the voyage, by which the men are paid, occaſions this extraordinary induſtry, and dexterous management, every man for his own intereſt here exerting himſelf, encouraging and ſtriving to get before and excel each other, in doing the neceſſary duty. When it happens that the ſhips come a ground, they readily firſt carry out a catch anchor and towline, and if that is inſufficient, they haul out a bower anchor by it, to heave the ſhip off. In heaving up their anchors briſkly with a windlaſs they greatly excel other merchant ſhips; but the difference of men as well as things, can only be known by compariſon. I had a ſhip in the merchant's ſervice, that hove with nine handſpikes double man'd at the windlaſs, to heave up the ſmall bower anchor, which we found ſo difficult and took up ſo much time, that to avoid the riſque we ran, in getting the ſhip under way in narrow waters, I was going to have this anchor changed for a leſs, till at *London*, I happened to employ a mate and ſeven men from a Collier to tranſport the ſhip to the Graving Dock at *Deptford*, when theſe ſeven men, only, hove up this anchor by two briſk motions, for each ſquare

Difference of men in heaving up an anchor.

of

of the windlaſs in a quarter of the time that it uſed to be done by eighteen men, and this difference was entirely owing to their dexterity, learned by great practice; they riſe with their handſpikes, and heave exactly all together with a regular briſk motion, which unites their powers into one. And they are equally briſk and clever in warping, or tranſporting a ſhip with ropes, and likewiſe in handing, reefing, ſteering, &c.

ON THE IMPROVEMENTS OF THE WINDLASS.

SINCE my mentioning in the firſt edition the great difference of men employed in heaving at the windlaſs, which is certainly much the beſt machine to work the ground tackle for ſhips that carry few hands, there have been two Patents got for the improvement of it. The firſt by Mr. *Stephen Wright*, of *North Shields*, a ſhip maſter in the coal trade to *London*, which deſervedly continues in general practice, owing to the great advantages attending it, not only by the friction being greatly leſſened, by its turning on an iron axis, but by its having iron palls at the windlaſs bitts, added to thoſe amidſhips, made to ſtop at every ſixteenth ſquare, inſtead of every eighth, by which latter practice the people were often much hurt. And it proved its advantages, in company with a fleet of ſhips at anchor; for he was enabled to heave his ſhip a head againſt a ſtrong wind and waves, and hove up his anchor with ſafety to his people, and left the others all behind where they were obliged to lay for more moderate weather to get their anchors, by which he got his Patent, and very juſtly ſupported it, when repeatedly tried at law, and I think deſerves the thanks of the public for this very great improvement of the windlaſs.

THE other Patent was got by Mr. *Moor*, a great Mechanician in, *London* and called *Moor*'s Balance Palls, which had a great run in practice for a time, and was uſually fixed to the end of *Wright*'s windlaſs, then commonly called the double Patent windlaſs. But it hove with a long bar, that made it very heavy to lift up, and its power was ſo great, when they hove a ſtrain, that it bent and ſpoiled the iron axis of *Wright*'s windlaſs, ſo that it was ſoon out of practice. But though it failed in this deſign for ſhips, I think it did great credit to *Moor*'s mechanical genius, for, what I imagine was its firſt deſign; a tradle to give motion to a wheel carriage.

I cannot

I cannot help thinking, on this occaſion, that, if experiments were tried, a greater additional power than Mr. *Moor*'s balance palls, and which would work much eaſier, might be applied with great advantage to the body of *Wright*'s windlaſs, without any danger of hurting it. And this might be of great ſervice not only in ſhips that are obliged to carry large boats or lumber, ſo near their windlaſs as hinder their heaving with bars in the holes near the midſhips but at all times and on all occaſions when either quick heaving or a great ſtrain is required, which in my opinion would make it of great importance to ſhipping.

BUT the real advantages that attend improvements of this kind, cannot be known but by making fair compariſons from experience. In the year 1750, I was concerned with that worthy Hero, Cap. *Fortunatus Wright*, in purchaſing and fitting out the LEOSTOFF, 20 gun frigate of war, with a long windlaſs that hove with common bars; as mentioned page 132.

THE method *then* of making a windlaſs, was of one large piece of timber; which increaſed its price; and the longer it muſt be, and more bar holes which it muſt have for large ſhips, made it the weaker to bear a great ſtrain, heaving no palls at the windlaſs bitts, but only thoſe amidſhips, which only ſtopped at every eighth ſquare. So that in good holding ground in roadſteads, when heaving a peak to weigh the anchor when the waves run high and the palls are near but could not be hove down, the quick riſe of the ſhip, by the ſwelling waves, has ſometimes hove the men over the bows; and ſuch a great ſtrain is brought upon theſe common long windlaſſes, as to break them; and by which we had our windlaſs broke, which put us to great difficulties in purchaſing our anchors with the capſton, with the few hands we could afford to carry.

THESE great defects certainly prove the vaſt and important advantages of *Wright*'s windlaſs, to preſerve the people from harm, when heaving up an anchor at ſuch times as laſt mentioned. Even with his improved windlaſs, he told me the cautious method he took, which I think deſerves notice here; which was; when hove to a long peak by the windlaſs till a great ſtrain is felt upon it by the ſhip's quick riſing with the waves, then to leave off heaving with the bars at the windlaſs, and hove the windlaſs round with a briſk motion by a ſingle rope gigger at the capſton, as the cable ſlackened by the fall of the ſhip's bows in the hollow of the ſea; ſo that they had only to hold on the cable with the capſton till

till the great ſtrain was over by the riſe of the waves, which weighed the anchor, and then the people left the capſton and hove the anchor up with ſafety at the windlaſs, which I think does great credit both to his conduct and his windlaſs.

ON IMPROVEMENTS OF THE WINDLAS BARS.

ALL that I aim at on this occaſion, is to propoſe bars to increaſe the power of this excellent windlaſs, without being liable to hurt it as before mentioned. And that I propoſe for this purpoſe, is to have long ſtraight bars, twelve or more feet long, according to the height of the windlaſs, and made about three or four inches ſquare, (the breadth of the windlaſs bitts) to be tapered away, round to each end, the ſame as a common bar, and worked on the body of the windlaſs, either on what is called the ragged wheels for the iron palls at the inſide of the windlaſs bitts, or on the eighth ſquare of the windlaſs between them and the pall bitts amid-ſhips.

THE bars that are to be made to heave by the two ragged wheels; and when the ſquare and all the palls are properly down, the middle of the bar is to be laid on the windlaſs, cloſe to the bitts, right above the top tooth of the ragged wheel, with the fore end down to the deck; then form a mould for a curvid iron claw to be fixed about the fore ſquare part of the bar, that the claw may juſt reach and hook the fifth tooth from the top one at the fore part of the windlaſs; and another mould for what I call an iron ſtep, fixed on the bar juſt to reach the upper part of the ſecond tooth from the top one of the ragged wheel on the after part of the windlaſs, ſo that the after end of the bar will be juſt ſo high that a man may reach it from the deck, which poſition, with the length of the bars, will certainly give men, heaving at them, very extraordinary advantages over the common bars to increaſe the power of the windlaſs.

FOR it is well known that working men in general, by their wonderful muſcular ſtrength, can lift twice their own weight; and many ſtrong men a great deal more; ſo that a man at the fore end of theſe bars near the deck, when a great ſtrain is required, may heave or lift upwards twice his own weight, or more

more in proportion to his ſtrength; and a man at the after end of the bar can heave downwards *wholly* his own weight, at the ſame time, when, men ſtanding *upright* at the top of the windlaſs with the common bars, cannot heave *half* their weight; and from the length and ſtrength of theſe long bars (that may be double manned) I reckon the power of the windlaſs may be above trebled by them; and our *Eaſt India* ſhips might work their ground tackle by them on their fluſh decks, which would certainly be a great advantage to them.

BUT it muſt be allowed, that theſe long bars can only heave one eight ſquare of the windlaſs at a time; yet as they can be ſo much more readily and eaſily ſhifted than common bars can be unſhipped and ſhipped again to heave, and their length and weight being ſo equally poiſed upon the windlaſs, in my opinion, they will afford ſo many great advantages to ſhipping, as to contribute greatly to ſafety and ſucceſs in proceeding, by being enabled, not only to heave a head and purchaſe heavier anchors than are commonly uſed to ride by, but to heave them cloſe up much ſooner after they are a weigh, by quick heaving: for want of which improvement many ſhips get on ſhore, or on board other ſhips in getting them under way where there is little room; which has been my caſe, as has been noticed; for a ſhip is not under command of the helm, either to ware, ſtay, or even to ſteer, while the anchor is much below the bows.

THESE important reaſons made me very deſirous to get a fair trial in practice. Having thought of different methods, I got an opportunity, and begun with my firſt thought, to get one made to heave on the ragged wheels on the body of *Wright*'s windlaſs, as above mentioned; but the ſhip ſailed before it was compleated; when all who ſaw it, allowed it was very promiſing to anſwer its deſigned purpoſe.

IN making this bar to heave upon the ragged wheel, I thought of another method to make it upon a more eaſy and ſimple conſtruction, that would heave with equal power as the laſt mentioned on *any* windlaſs, the common as well as *Wright*'s, where the eight ſquare is retained near the bitts in the form they are made; but no opportunity offered to get it tried in practice. I got a model of a windlaſs made with four common bars in proportional dimenſions; two to heave at each end of the windleſs; for I would not have theſe long propoſed bars to heave the end of *Wright*'s windlaſs, which would ſpoil its iron axis by their great power, as has been mentioned;

mentioned; but they may be uſed at the ends of the common windlaſs without any danger of hurting it; and on trial they anſwer ſo well in heaving the model of the windlaſs above mentioned, that I doubt not of their anſwering the important propoſed purpoſes which I have endeavoured to deſcribe, if they had a fair trial in practice, by ſea officers of a mechanical turn that love improvements, without which they cannot be gót forward.

BUT that people may judge for themſelves by a fair compariſon, I got a copper-plate engraved, repreſenting men heaving a great ſtrain at the windlaſs, with the common and propoſed improved bars, with the cable leading towards the hauſe hole, as repreſented at the bottom of plate the 5th; by which I hope their advantages will be perceived, and how eaſily they may be made, to try the experiment in practice.

THE one that I got made to heave upon the ragged wheels of *Wright*'s windlaſs, as before deſcribed, was ſawn from ſtrait grained, three inch *New England* plank; which ſeemed to anſwer the purpoſe very well. But to make theſe bars to heave upon the eight ſquares of *Wright*'s windlaſs, as repreſented in the plate; the ragged wheels and their iron palls ſhould be ſunk in the windlaſs bitts; and where there is room, two more may be made to heave cloſe to the pall bitts, where the windlaſs retains the true eight ſquares, as they ought to be made true to do for this purpoſe; ſo that when four of theſe long bars, double manned, can heave on the body of *Wright*'s windlaſs, it need not be made ſo long as it muſt neceſſarily be to heave with common bars; and the ſhorter a windlaſs is, and the leſs holes cut in it for the common bars, the ſtronger it is to bear the great ſtreſs and ſtrain of large heavy ſhips, which, by this method of heaving, the body of *Wright*'s windlaſs needs to be made no longer than juſt to give room enough to work the cables, without any holes for the common bars to weaken it; by which means, in large ſhips, the neceſſity of having cumberſome bitts abaft the windlaſs to prevent its breaking, may be avoided.

IN making theſe *Bars*, I would recommend firſt to make a mould for the bar, of a piece of ſheathing board, as repreſented plate the 5th; fig. 1, the middle of it made to fay to the top eighth ſquare and the next ſquare before it of the windlaſs. When the palls are all down, the *fore* end of the bar muſt ſlant down, near to the deck; and the after end riſe ſo high, that a man can juſt reach it fairly from the deck; and by this mould the

bar may be made, ſawed from ſtraight grained, three inch plank, as before mentioned.

BUT the ſquare of the *Bars*, muſt be made to preſs and bear entirely upon the after corner of the upper ſquare of the windlaſs, but to cut and leave about half an inch play towards the fore corner of the upper ſquare of the windlaſs, as repreſented plate the 5th; that when the ſquare is hove down, it gives room and admits the bars to turn eaſily forward to fetch and lock again for the next ſquare, &c.

THE *Claw* is to be made to fit and be adapted to the other fore ſquares, and one half of the under one, of the windlaſs. The *claw* muſt be made of a flat iron bar, about three inches broad and half an inch thick, doubled, leaving a ſpace in the doubling equal to the breadth of the windlaſs bar, to which the *open* ends of the iron bar (which now makes the *claw*) muſt be faſtened with wood ſcrews.---To prevent the narrow edges of the *claw* from chafing the ſquares of the windlaſs, the ſpace or hollow of the *claw* may be filled up with fir, faſtened with ſmall wood ſcrews.

EXPLANATION of the PLATE.

Fig. 1. Repreſents the Bar.

Fig. 2. Repreſents the Claw.

Fig. 3. Is the Bar with its Claw fitted to the windlaſs.---A is the *fore* end of the Bar ſlanting down near the deck.---B. the *after* end of the Bar, riſing ſo high that a man can juſt reach it fairly from the deck.---*a a a a* the Claw as faſtened to the Bar, and fixed to act upon the body of the windlaſs C-----D the cable leading towards the Hauſe Hole.

IF the ſhip in her way to ſea, requires a qualified Pilot, who is liable to be called to an account for any misfortune, it is but reaſonable that he ſhould be obeyed, and conſulted by the ſhip's officers, and that they ſhould ſee that all things neceſſary, both men, and materials, be ready to proceed in proper time, otherwiſe the Pilot may juſtly refuſe to take charge of the ſhip; from the want of theſe neceſſary preparations I have known many bad accidents happen.

THESE ſhips in general, I can ſay from experience, compared with the colliers juſt mentioned, are under great diſadvantages in the dexterity of their men to work and manage them, in narrow channels and tide-ways, their crews in common being a mixture of good and bad ſeamen, and in heaving up their anchors with a windlaſs, the efforts of the good men are loſt among the bad, who for want of practice or a willing mind, do not keep time to heave altogether with the good men, but heave in a lubberly manner one after another, which occaſions the great difference mentioned in heaving up that anchor, which ſeven men performed, much better than eighteen whoſe ſtrength was ſo divided. Sailing by the month inſtead of by the voyage, makes the lazy bad part of a ſhip's crew more backward in doing their duty, as being no ways intereſted to expedite the voyage.

IF the channels are narrow, with ſwatches joining them, that occaſion croſs tides amongſt ſhoals that are under water, all poſſible pains ſhould be taken to get two objects for leading marks that lie nearly in the ſame direction with the channel, which are much better than any ſingle mark, buoy, or beacon, which ſingle mark a ſhip may be kept ſtemming towards, and may ſeem to go in a fair way to it, yet by the tide or lee way, may be carried inſenſibly out of the channel on ſhore, by which I have known great loſs and damage occaſioned, for want of this being ſtrictly noticed and guarded againſt, by obſerving the true bearings of the compaſs, or the lead and its ſtray line, how the ſhip goes over the ground, different to what ſhe ſtems.

Why two objects for leading marks ſhould be endeavoured after.

GOING with the ebb tide, makes it much more dangerous than proceeding with the flood, and eſpecially where there is a great flow of water, which falls in proportion, ſo that if the ſhip comes a ground there is little chance of getting off again that tide, therefore it requires the more care and caution, and when it happens that you are obliged to proceed forward in the night, if a boat can be ſent to ſhew a light where the buoys or dangers lie, that you

have to paſs, I can ſay from experience, it may often prove a good method to keep clear of the ground.

IF it happens by the ſet of the ebb tide, &c. that the ſhip is found to be out of the proper channel upon a ſhoal, and the wind ſo that you cannot ſhoot her off with the ſails, it ſhould be immediately reſolved what is beſt to be done, whether the time of tide affords water to give the ſhip a chance to drive over the ſhoal, or you ſhould let go the anchor, and endeavour to warp into the channel again; this has been my caſe, when I ordered the anchor to be let go, and begun to warp, but the tide fell ſo faſt that the ſhip grounded upon the ſhoal, and I perceived afterwards ſhe would have had water enough to have drove over the ſhoal, if we had not let go the anchor.

The lower yards may be uſed as ſhores on occaſion.

WHEN a ſhip comes aground, which is liable to take a great heel and may ſtrain as the tide leaves her, the topmaſt ſhould be ſtruck that they may come eaſily down while ſhe continues upright, and ſhe ſhould be eaſed from all tophamper, or it ſhould be laid as low as poſſible, and when ſhe begins to take her heel, the main and fore yards may be uſed for ſhores, and laſhed to the chain plates, ſcuppers, &c. by which not only their weight is taken off the ſhip, but they may ſupport her from ſtraining, and when neceſſity requires it, the ſpare booms may be uſed for ſhores; and to laſh iron crows with the ſharp end below the end of each ſhore, may be a means to keep the lower ends faſt to the ground.

The compaſs and courſe to be looked after.

Now we may ſuppoſe a ſhip got to ſea clear of theſe dangers that required a Pilot, who has now left the ſhip to the management of the commander, and proper officers. And when the courſe that is to be ſteered is ordered, the compaſſes ſhould be examined to ſee that they traverſe freely, and ſhould be compared how they agree with each other, both in and out of the binacle, and in comparing them, they muſt be placed at the diſtance of two feet, at leaſt, a ſunder, for a reaſon which will appear in the next chapter. The binacle ſhould be cleared of all iron from about it, and if the commander be otherwiſe engaged, a proper officer ſhould be appointed to attend to the courſe ſteered, and to the ſoundings of the lead, if it is kept going, to avoid what I have known in many inſtances, of ſhips being run on ſhore by courſe, when the blame has been laid on the compaſs.

Ports and hatches to be ſecured

WHILST one officer takes care of the ſhips courſe, &c. the other officers with the whole crew, according to their ſtations, ſhould be properly employed, in clearing and preparing the ſhip to

contend

contend with the turbulent waves of the ſea, to prevent and guard as much as poſſible, againſt the bad and fatal conſequences, which I have known to happen from ſhipping water before things have been properly ſecured. That the people may be properly refreſhed with ſleep, which nature demands, to enable them to do their duty as it ought to be done. As ſoon as things are got to rights to admit of it, the watch ſhould be choſe and ſet.

ON SHIP'S COMPASSES.

WHERE there are ſo many lives, and ſo much property depending on good Compaſſes, I have been ſurprized and vexed to hear ſome people begrudge the price of Dr. *Knight*'s improved ſteering and azimuth Compaſſes. I thought, when I bought one of each, they not only deſerved the price, but the inventer the thanks of the public, as a trading nation and a maritime power for ſo great an improvement in that important inſtrument. The needle which governs the card in this, is a ſtrong artificial magnet of itſelf, and having an aget ſocket traverſes upon a poliſhed ſteel center pin, ſo that the ſhip's head cannot move the leaſt degree to one ſide or the other, but theſe compaſſes inſtantaneouſly ſhew the motion, by which much better and ſafer ſteerage may be made, than with our common compaſſes, which are made very ſlight and imperfect, with needles that contain very little magnetic power, and have only rough, ſoft, braſs ſockets and center pins, which ſoon blunt, and are liable to be out of order, ſo as to prevent the card from traverſing freely. A ſhip may move a great way from her courſe before it can be perceived by a bad compaſs, which may occaſion dangerous ſteerage in ſpite of the beſt helm's man. Therefore, the beſt of compaſſes ſhould always be allowed, and various kinds; as the difference will be but a little in the expence of a ſhip's out fit.

SOME late obſervations, and ſeveral experiments which I have made myſelf relative to them, prove, that a very material error in the courſe may be occaſioned by having two compaſſes, with needles of ſtrong magnetic power, at the ſame time in the binacle. For it is found that by their action one upon the other, they will vary, from two to three points, from the truth, when ſuffered to ſtand

ſtand too near each other; a circomſtance which it is very neceſſary a commander of a ſhip ſhould be apprized of, that he may be upon his guard.---And it muſt be obſerved, that, the better the compaſſes the more liable they are to deviate from their true magnetic courſe: and the error will keep increaſing in proportion as the ſhip is ſteering towards the S. W. or N. E. or N. W. and S. E. courſes, when put cloſe together they deviate two or three points. A veſſel, ſailing from *Whitehaven* with two compaſſes in the binacle with powerful magnets, gave occaſion to this remark; for the Captain found them ſo erroneous that he put back again. And experiments I made in the preſence of ſeveral judicious friends ſhewed the remark was a juſt one. Even on board a King's ſhip, I found (though the light room was large) two of Knights compeſſes, placed as far as could conveniently be a ſunder, yet affected each other a quarter of a point. I would therefore recommend the adopting the improved patent Binacle, in which one good compaſs, conveniently placed, anſwers every uſeful purpoſe, nor is liable to the above error.

ON SHIPS AND BOATS COMPASSES.

BUT of late years, there has been very great improvements made in ſhips compaſſes, for to make them ſtand the ſhock that ſhips and boats receive from waves, that has hitherto made the compaſſes vibrate from their true magnetic direction, which I have experienced, even Knights compaſſes to do.

As ſoon as I heard of the excellent principals of theſe compaſſes, I endeavoured and got one that was made by Ramſden, in *London*; with a ſpare light card when uſed in boats, which has hitherto been very much wanted, and ſent them for trial to ſea in one of our *Liverpool* Pilot Boats and had a good report of them.

BUT of late, I have ſeen here, one of Mr. M'Cullock's patent Azimuth Compaſſes from *London*, made on the moſt maſterly ſcientific principals and machaniſm, and a pamphlet with plates, deſcriptions and reports of it, and ſteering compaſſes for ſhips and boats; with the comparitive ſurpaſſing great advantages over other compaſſes, from good authority by fair trials; which in the whole I think does honour to our country as a great maritime nation. And eſpecially for his ingenuity in fixing the ſhort pivot faſt to the center

center of the ſtrong magnet, that makes it traverſe and turn ſo much eaſier with the center of motion ſo near the center of gravity, which is certainly a very great improvement.

ON CHOOSING THE WATCHES.

THE crew as far as they are known to be good and bad, ſtould be equally divided and they ſhould be told by the commander that the ſafety, eaſe, and ſucceſs of the whole depends chiefly on every one doing or getting the neceſſary duty done, with watchfulneſs, care and diligence, according to their different ſtations, which he is in duty bound ſtrictly to look after, and treat each of them as their merit, or demerit deſerves. The watch upon deck have upon them the important charge, not only of the ſafety of the ſhip and their own lives, but the lives of the other watch and all that are below, therefore any neglect of duty by the watch upon deck, and eſpecially in keeping a good look out, ſhould be reſented by all the reſt of the crew: the watch below ſhould lie down with ſuch cloaths on, as to be ready to turn out directly, when all hands are called, which may be to ſave the whole from immediate deſtruction. Theſe declarations help greatly to reconcile the crew in general, to that ſtrict diſcipline, which may be abſolutely neceſſary to be eſtabliſhed at the beginning of the voyage, and eſpecially when paſſing through dangerous narrow ſeas.

THE commanding officer of the watch, in my opinion, ſhould not be put under that too common reſtriction, of being obliged to wait for the approbation and orders of his captain, when any unexpected great danger appears to be very near, but it ſhould be recommended to him, to give ſuch orders as in his judgment he may think the immediate neceſſity for ſafety require, to avoid the neareſt danger, ſo as to give time to call on the captain to direct what is beſt to be done.

On ſhaping a Courſe, and managing through dangerous narrow Seas or Straits, where Tides or Currents run ſtrong.

IN ſeas where ſhoals lie interſperſed at a diſtance from the land, and where tides or currents run ſo ſtrong as may greatly alter both the intended courſe and diſtance (which has to my knowledge occaſioned many fatal loſſes) no pains ſhould be ſpared in ſhaping the Courſe to calculate how the intended courſe and diſtance is to be made good, for it is well known that a ſtrong tide or current has the ſame effect upon a ſhip's way at ſea, though it may not be ſo viſible, as in a river where it is plain to be ſeen, for which reaſon the ſetting and ſtrength of the tide or current, as near as can be got, ſhould be reckoned in the calculation, and ſet down in the log book as a courſe and diſtance in keeping the ſhips way the ſame as the log, which ought to be hove and remarked every hour, and this is not too often, becauſe in that time there may be great alterations in the ſhips way, as well as the tide.

The tides or currents to be noticed.

FOR theſe reaſons as well as on other important occaſions, every prudent diligent officer, ſhould endeavour to get all the helps he can come at from tide tables, books, charts, &c. to make himſelf as well acquainted as poſſible with the tides, and ſhould take all favourable opportunities to try and remark the ebbing and flowing, ſetting and ſtrength of the tides as well as of the currents, that may be found in their track of navigation, in order to form a judgment how to allow and reckon them as a courſe and diſtance, in the account of the ſhip's way, as above recommended. This will certainly help him to come much nearer the deſigned courſe and diſtance in the account of them, but the velocity of the tide varies with its height, which will be mentioned from obſervations that cannot be aſcertained by theory, and many other unavoidable errors occur in practical Navigation, which makes it ſo uncertain, and differ ſo much from the theory that makes the ſhip's reckoning anſwer to the greateſt nicety upon paper, when in reality ſhe is often found at a great diſtance from what was expected.

The uncertainty of practical navigation at ſea.

THEREFORE as ſo little dependance is to be put in reckoning the ſhip's way or place, it ſhould not be thought wonderful in the courſe of a long winter's night, that inſtead of ſteering clear, or falling in with a place as expected, the ſhip is often found in another place, or from being on one ſide of the channel, ſhe is found unexpectedly on the other, which makes it abſolutely neceſſary,

and

and eſpecially in the night or thick weather, to proceed with the utmoſt care and caution under ſuch ſail as the weather and ſituation will admit, ſo as to make the ſhip eaſily managed; a good look out being always properly kept. Whenever it happens that real danger unexpectedly appears, let not perverſe obſtinacy take place ſo as to loſe time in doubting and diſputing, but immediately uſe the beſt means to avoid the danger.

Care and caution, and means uſed to avoid dangers when they appears.

THE anchors and cables ſhould be kept as ready as poſſible on theſe occaſions. If the place you have fallen in with, cannot be known by the appearance it makes, take the bearings and extent of it each way by the compaſs, the depth of water, &c. and compare them with the chart of the place. This is the readieſt and moſt likely means to find where you are, and which may be of the utmoſt conſequence in proceeding forward or retreating, by this freſh departure being right; for I have known many loſſes occaſioned by taking one place for another.

To find out your ſituation.

ON TURNING TO WINDWARD IN A NARROW SEA.

HOW far may it be right or wrong in bad weather, to keep beating againſt contrary winds in dangerous narrow ſeas, may be a diſputed point, and muſt be left to the diſcretion of the prudent and diſcerning officer, who will conſider his riſque, wear and tear, with all the advantages, or diſadvantages that may attend beating at ſea: and that if obliged to bear away for a road ſtead, even there, the wear, and ſometimes the loſs of the ground tackle, muſt be conſidered; alſo that the ſhip is liable to drive, or be drove on board of by other ſhips. The riſk of going into and getting out of a port or road ſtead ſhould alſo be conſidered. So that when a ſhip can be kept at ſea with any prudent degree of ſafety, though ſhe cannot gain, but may loſe ground; yet the chance it gives of being in a fair way for a change of wind, (and that varying but a little,) it may give an opportunity of making ſlants to get round a point or head land, or through the narrow ſea into the open ocean: by which bravery there have been many inſtances of ſhips making a voyage: one did ſo to the *Weſt Indies* and back again from *Liverpool*; whilſt others were waiting there all that time for a fair wind.

BUT in a tide way, when the wind, weather, and navigation are ſuch as will admit a ſhip to ſtop tide, it gives ſo great an advantage to gain ground to windward, that it may be deemed wrong

to lie waiting for a fair wind; for it may be, that the ſhip not only gains all that the tide runs her to windward, but it makes her hold a better wind to make her ſail faſter a head, than ſhe would do with the ſame breeze of wind in ſtill water; conſequently ſhe makes leſs lee-way; ſo that in ſmooth water it may be reckoned that the ſhip gains about one third to windward of what ſhe ſails by the log, as mentioned page 78: this, added to what the tide runs, may gain a great way to windward in a tide's working.

Remarks when ſtopping tide.

When a ſhip comes to an anchor at ſlack tide, and the cable is veered out to ride by, all the lee tide, then heaving the lead, and the log every hour after, till the next ſlack tide, will give a favourable opportunity to obſerve the ſetting and ſtrength, or velocity of it and what it ebbs or flows in every hour the whole tide, as alſo the time of each ſlack tide, with the moon's age, and her diſtance from the earth if it can be got; all which deſerve to be particularly remarked in the journal,

WHEN the wind happens to blow ſo that the ſhip will lie up aſlant upon one tack, nearly to ſtem the lee tide; then the beſt management is, to ſtand on the other tack, with the windward tide, as far as the ſituation will admit with ſafety to get and keep to windward; which may give the opportunity to ſtand upon the ſlant; tack the whole lee-tide, ſo as to loſe little ground, and ſave the riſque of ſtoping the lee-tide, by coming to an anchor.

To ſail towards ſhore the firſt; of the tide, and off the latter part of it.

IT deſerves to be noticed, that in narrow, ſeas or wide channels where the tides run ſtrong, both flood and ebb, they begin firſt to run in ſhore, and run a great deal longer in the offing; therefore the advantage ſhould be taken to ſtand as cloſe in ſhore as ſafety will permit at the firſt making of the windward tide, and to ſtand to the offing the latter part of it; by which management our coaſting ſhip's from being well acquainted, beat through the King's channel againſt freſh contrary winds that keep other ſhips windbound.

ON TAKING A DEPARTURE FROM THE LAND.

NOW let it be ſuppoſed that a ſhip has got far enough to ſea to take her departure from the land, and is going to be navigated in the open ocean. The departure ſhould, if poſſible, be taken from ſome remarkable head land or place that has its latitude and longitude well laid down in your books and charts; and

and if it lies in a fair way for a land-fall homeward bound, the more pains ſhould be taken to get an obſervation with all the quadrants on board well adjuſted according to rule; for which purpoſe you ſhould examine how they agree with each other, and how they anſwer to the bearing and diſtance of the land of departure in ſight as laid down; and a rough ſketch of the appearance it makes ſhould be taken, as alſo the ſoundings, at the ſame time, if they are a guide to the coaſt; all which ſhould be fully remarked in the journals, not only for the reckoning outwards, but for ſafety in making a good land-fall, homeward, which depends much more on your own obſervations and remarks, than what can be found in any books or charts.

Difference between the Theory and Practice of Navigation.

AFTER the departure from the land is taken, then begins what we call the art of navigation, which, by mathematical rules, gives the true courſe and diſtance from one place or port to another, only by latitudes and longitudes being given, to reduce the various traverſes a ſhip often makes in twenty-four hours into one courſe and diſtance, and to find the latitude and longitude the ſhip is in, by account, every day at noon; which, by theory, can be made to anſwer to the greateſt nicety, ſo that a learner at ſchool, can keep a reckoning of a long run, and make the deſigned land-fall agree to a mile with his account of the ſhip's way; but in practice it is found from experience, that it cannot be done ſo as to be ſolely relied upon, even by ſeamen of the greateſt capacities, whoſe chief dependences, as before noticed, muſt be therefore on lead, latitude and a good look out.

THE difference between the Theory and Practice of navigation, ariſes from defects in the methods and inſtruments which we uſe in ſteering, and in the meaſuring and marking down the ſhip's way; and alſo in not making proper allowance for bad ſteering, lee-way, ſhip's driſt, or bearing away from the true courſe in ſqualls, variation of the compaſs, and tides or currents; all which cannot be brought exactly to a regular account, but are liable to errors, depending much upon mens different judgments in correcting them: therefore each of theſe articles deſerve to be particularly noticed, as they occaſion not only the above difference, but the

difference of one ſhip's reckoning from another on the ſame paſſage; and alſo one man's reckoning from another in the ſame ſhip.

ON STEERING IN GENERAL.

THE difference between good and bad ſteering is of ſuch conſequence to navigation, that it deſerves particular regard; becauſe good ſteering not only gives nearly the true courſe as ſteered by the compaſs, but the ſhip ſails much faſter and farther in the ſame time, and with much more eaſe both to the helm's-man and the ſhip in a gale of wind with turbulent waves; for whatever a ſhip goes from her ſtraight courſe, ſhe ſhortens her diſtance gone ſo much, and requires more helm, which works and makes both ſhip and helm's-man very uneaſy; and when carrying a preſſing ſail, there is great danger of the ſhip being broached to, which may prove fatal to the whole: therefore all hints or helps, and every thing that good ſteering depends upon, ſhould be made as eaſy and plain as poſſible. That moſt valuable inſtrument the *Compaſs*, has been already ſpoken of, ſee page 141.

ON THE STEERING WHEEL.

THE great advantages experienced from ſteering a ſhip with this excellent machine, has occaſioned it to become more and more in uſe; even ſmall ſhips that uſually have their tillers upon deck, frequently now ſteer with a wheel, which gives the helmſman an additional power to command and move the helm at pleaſure; and as he ſtands firm on one ſpot, he can keep his eyes fixed on any mark a-head, or on the compaſs, and obſerve to a great nicety the ſhip's motions or tendency to go from her courſe: ſo that ſhe may be ſteered ſteadier, and confined nearer to her true courſe by the wheel than by the tiller, which the helmſman muſt move along with from ſide to ſide as the ſhip requires, by which he cannot diſcern her motions ſo nicely, nor has he equal power to move the helm as occaſion requires.

As the advantages of the wheel are ſo great, they deſerve the more pains taken to have them made as perfect as poſſible. The barrel of

of the wheel, ſhould be exactly proportioned to the ſize of the ſhip, that either three or five turns of the wheel-rope may be juſt long enough, ſo as to loſe neither power nor time, in moving the helm three points of the compaſs each way from the direction of the keel, (as mentioned in page 47.) And as moſt of our wheels have eight ſpokes, and ſome large ſhips have nine or ten, the handle part of each ſpoke ſhould be marked, ſo as they may be diſtinctly known by feeling, as they paſs through the helmſman's hands. The midſhip ſpoke where the wheel-rope is nailed, may be marked with a rope-yarn, as in common; and the third or fourth ſpokes on each ſide may have I, II, III or IIII notches cut with a knife; ſuppoſe on the fore ſide of the wheel on the ſtarboard ſide, and on the after ſide of the wheel on the larboard ſide. The half turn ſpoke (if there is one) to be plain without any mark. By theſe marks it may be readily known where, or how far the helm is on either ſide, though the tiller is below and out of ſight; and it gives the helmſman the liberty to uſe his eyes intirely in obſerving the ſhip's motions, and to ſteer her to the greateſt advantage.

To have the ſpokes of the wheel marked.

I THINK the ſame kind of marks might be made to advantage on the out and inſide of the ſpokes of *horizontal-wheels* that ſteer with tooth and pinion; and eſpecially when the collar goes abaft the rudder head. This I look upon as an improvement in many reſpects; but do not ſpeak from my own experience.

ON STEERING A COURSE.

IT is certainly the duty of the officer of the watch, to uſe his utmoſt endeavours to get the ſhip ſteered as near the courſe that is ordered as poſſible; and when the ſhip is perceived to be going exactly her courſe, by the compaſs, the helmſman ſhould be adviſed to look and find a mark a-head that will not ſoon alter, to ſteer by; and only to look at the compaſs now and then, as occaſion may require, to obſerve wether the mark alter afterwards ſo as to make it neceſſary to find out another that will anſwer nearer to the courſe; for it is well known that a learner will ſteer a ſhip to a greater nicety by a mark a-head, than a good helmſman can do without a mark by the compaſs alone.

A GOOD

A GOOD helmſman, when a ſhip is difficult to be ſteered, at taking the helm, firſt obſerves how it lies; then looks with a ſharp eye which way the ſhip is inclined to go from her courſe, and moves the helm with a briſk motion far enough to ſtop her that way, and feels by the ſtreſs upon the rudder ceaſing, (which feel ought always to be noticed, as well as any alteration to the eye) when it is a proper time to eaſe the helm to prevent her from going on the other ſide of her courſe; for a ſhip is no ſooner ſtopt by the helm from going to one hand, than ſhe will incline to the other hand, if the helm is let lie in that place; therefore he keeps moving the helm with a briſk motion, as far as is found neceſſary, to confine her to the courſe; and by feeling the marked ſpokes of the wheel, as they come into his hands, ſoon perceives how much helm, and how far ſhe requires it each way, to command and ſteer her ſteadily along, with the leaſt helm, and leaſt trouble to himſelf.

A BAD helmſman, inſtead of endeavouring to confine the ſhip to her courſe, by moving the helm each way, as above mentioned, commonly lets the helm lie until he ſees the ſhip is got on one ſide of her courſe, then moves it ſo far as to bring her to her courſe again before he offers to ſtop her, or meet her with it, till ſhe gets on the other ſide of her courſe, ſo as to require a great deal of helm both ways; by which the ſhip is ſteered but little right forward, but is kept yawing about from one ſide of her courſe to the other; which ſhortens the diſtance gone, and makes both courſe and diſtance very uncertain, and works the bad helmſman as he works the ſhip from ſide to ſide; which makes both very uneaſy; and if the waves run high, when carrying a preſſing ſail, large, by ſuch bad ſteering there is great danger of broaching the ſhip to; therefore none but the beſt helmſman ſhould be permitted to ſteer at ſuch times.

On ſuiting a SHIP with SAIL that ſhe may be well Steered.

WHEN it is difficult to ſteer a ſhip, her officers ſhould take care that her ſails are kept properly trimmed, and that ſhe is not over preſſed with ſail; eſpecially after ſail; which may make her ſo ungovernable, as to put it out of the power of the beſt helmſmen to ſteer her, with all the helm that can be given her:

her: therefore the helmſman ſhould always be told to acquaint the officer of the watch when the ſhip gripes ſo hard that the helm hard a weather, or hard over each way, will not command her, that the ſails may be better trimmed, or afterſail taken in, or more headſail ſet, as the occaſion may require.

ON STEERING UPON A-WIND IN THE OPEN OCEAN.

IN a variable wind's way, when a ſhip has got ſea room, clear of the land, I have thought it a wrong practice to ſteer upon a wind by the vanes, and the ſails juſt touching full; which ſeldom give a direct courſe, but vary as the ſhip comes to, and falls off; which makes both courſe and diſtance the more uncertain; therefore a courſe ſhould be ordered to a point, or half a point of the compaſs, as the wind will admit, to ſteer the ſhip with a full ſail; and only look at the vanes to ſee if the wind alters, that the courſe may be altered accordingly: by this means a truer courſe as well as diſtance may be got: eſpecially if the ſhip lies aſlant towards her true courſe, it is the more neceſſary, as the ſhip will ſail the faſter, and make leſs lee-way; and this laſt ſhould be well conſidered, becauſe the ſhip's real courſe by the compaſs depends much upon making a proper allowance for her lee-way.

ON MAKING ALLOWANCE FOR LEE-WAY.

THIS, in a moſt inconſiſtent manner, is generally left for twenty four hours to the judgment and memory of the different navigators, who probably are below a ſleep, or their attention taken up with other things great part of the time; this therefore muſt make the allowance for lee-way very uncertain, as it is liable to vary, and be more or leſs every hour, as the wind happens to vary, blow leſs or more, or the waves run higher or lower, more a head, or a ſtern of the ſhip, and as ſhe has been ſteered upon the wind, though under the ſame ſail; and differs greatly from any ſchool boys rules, that can be propoſed, of allowing more or leſs lee-way, according to the ſail a ſhip can carry; for it is well known that two ſhips may be in company with

with equal ſail ſet, when one, by her conſtruction and trim, may not make half ſo much lee-way as the other.

THIS defective and uncertain manner of making allowance for lee-way, in my opinion, is one of the principal cauſes and reaſons that can be given, why the reckonings in the ſame ſhip ſhould differ ſo much from each other, when the courſes and diſtances that the ſhip's way is reckoned from, are all taken from the ſame log-book; which if no miſtake be made in the calculations, ſhould make them all nearly agree.

WHAT in my opinion would contribute greatly to leſſen this defective part of navigation, is to have a quarter of a circle of ſheet lead, divided ſo as to make the eight points of the compaſs, and nailed upon each quarter, with one ſide parallel to the keel, and the other to the beam, as they have in moſt capital ſhips; by which the ſhip's wake, or drift, that ſhe goes to lee-ward of what ſhe ſtems by the compaſs, may be ſet to a ſufficient nicety upon both tacks, by the officer of the watch, who ſhould make the allowance, and ſet down the real courſe or drift made by the compaſs, every hour; which by this means will certainly come much nearer the true courſe, than when left without any rule, to different peoples memories, and judgments, as above mentioned.

To have 4 quarter circles pointing to each quarter and bow.

HERE I think it proper to remark; as theſe quarter circles of lead are commonly made and cut from a whole circle of about ſix inches diameter, with the 32 points of the compaſs ſcratched out in ſtraight lines from the center, the other two quarters ſhould be nailed on each ſide of the baricado; or fore part of the quarter deck, pointing on each bow before the beam, as thoſe a-baft point a-baft the beam; ſo that any objects, ſuch as ſhips, points of land, ſhoals, buoys, or beacons, may be readily ſet by theſe quarter circles, to know how far they are before, or abaft the beam; and by obſerving how the ſhip ſtems by the compaſs at the ſame time, the bearing and alteration of bearings, may be eaſily and readily taken, which I can ſay from experience will often prove of great ſervice.

THIS method, defective as it is, muſt be made the moſt of, till a better is brought into practice. For it is well known how many ingenious Mechanics have repeatedly made promiſing trials, to meaſure a ſhip's way at ſea by machines without ſucceeding. We had one made at *Liverpool*, by means of an iron rod, to be fixed at the foreſide of the ſtempoſt, which anſwered very well by the mile ſtones in our canal; and, by ſubſcription, had it fixed for the inventor to go a voyage to *Jamaica* with; but it failed of ſucceſs; and he did not return with the ſhip.

THE learned have, with much ſeeming reaſon, recommended to us to have our log-lines marked fifty feet to a knot, and the glaſs to meaſure thirty ſeconds of time, which are exactly 120th part of a geographical mile, and of an hour, and muſt be allowed to agree better with exact calculation than our common practice of having but forty two feet of line, to a glaſs of twenty eight ſeconds of time; which line is four feet eight inches, or about a ninth part ſhort of the above proportion; yet, in our practice, this is found from long experience to meaſure very well a geographical or ſea mile of ſixty to a degree; which mile, in my opinion ſhould become general, and be uſed in the ſcale of all our ſea maps, inſtead of our Engliſh ſtatute mile, which is about a ſeventh part leſs; by which difference the unlearned may be deceived.

COMMON practice can only be proved to be right, by frequent fair trials. I was mate of a ſhip in the *Jamaica* trade from *London*, outward bound; and we marked the log-line ſeven fathom to a knot, (to a twenty eight ſecond glaſs as uſual) till we were diſappointed of ſeeing our expected land fall according to our reckonings. Our commander then aſked, "how had we marked "the log-line?" He was anſwered, ſeven fathom to a knot. He then ordered the line to be immediately new marked eight fathom to a knot; and ſaid "that the ſhip was one eight part ſhort of "her longitude, by the line being marked ſeven fathoms inſtead of "eight to a knot;" and ſo it proved; for we made the land as he ſaid. But in our paſſage home by this rule, we found the ſhip a great deal above an eight part of the longitude a head of all our reckonings; which nearly proved of fatal conſequence, as we were carrying all the ſail poſſible with a weſterly gale of wind and hazy weather; when we luckily perceived by the colour of the water that we muſt be in ſoundings; and it proved ſo; and we found ourſelves far up the King's channel in a fair way, and had eſcaped a great riſk of running the ſhip on ſhore unexpectedly

with all ſails ſet. This convinced me that it was not the fault of the log-line being marked ſeven fathom, but another cauſe that may be mentioned hereafter, and that is known always to have this effect upon ſhips in their voyages to and from the *Weſt Indies*, ſo as to make more difference of longitude out than they do home.

To mark the line and try the glaſs.

THE proportion of ſeven fathom of line, to a glaſs of twenty-eight ſecond's being right, is confirmed by the general practice in the *Eaſt India* trade, as well as all other trades that I have been in. My opinion is, that it will ſtand the teſt of any fair trial. In a voyage to *Leghorn*, the ingenious Mr. *Smeaton*, ſent with me for trial, a Sea-way Meaſurer, and what ſhould be properly called *Smeaton*'s and *Knight*'s improved compaſſes; for to my knowledge, the former contrived the mechanical part of them; and alſo his artificial Horizon for trials; which made me take extraordinary pains to have our log kept nicely marked as above, and to be hove regulary every hour, in order to find out by experience how many turns of this way meaſurer anſwered to a mile. To fix this to a great certainty, I took an opportunity that then offered, and ſteered to the weſtward, till we could ſteer a croſs the *Bay* of *Biſcay*, and along the coaſt of *Portugal*, as near upon the true meridian to the ſouthward as poſſible; where we reckoned there was neither tide nor current to affect a ſhip's way; and had the favourable opportunity of fair wind and weather, to compare our diſtance run by the log, to what was made by good obſervations for ſeveral days; and I found that they nearly agreed: which I think makes it evident that theſe proportions for the log anſwer very well if properly attended to; and therefore cannot be the cauſe which occaſions bad reckonings: and if it is an error, it muſt be allowed to be on the beſt and ſafeſt ſide; as it is better that the reckoning ſhould be rather a head than a ſtern of the ſhip, to put people upon their guard in proper time, ſo as to prevent the fatal conſequence that may attend an unexpected land fall.

Proportions for the line and glaſs.

THE readieſt and ſureſt way to make and try the log-line, is to have the whole length of the half knot (twenty one feet) meaſured and marked ſtraight along the deck; and to have the knots put into the line ſo as they may be eaſily ſhifted backwards, or forwards, as the ſtretching and ſhrinking of the line often requires. But before this is done, the half minute glaſs ſhould be tried, whether it runs exactly twenty eight ſeconds; that if it is found to run more or leſs, the line ſhould be marked longer or ſhorter

according

according to theſe proportions. As 28 gives 42, what will a ſecond or two more or leſs give? And this may be done ſufficiently near by the ſcale and compaſs. And the glaſſes may be tried by a muſket ball faſtened to a thread held ſteady in one hand, between the finger and thumb, axactly 30 inches from the ball; which muſt be ſwung by the other hand, and continued ſwinging more than 30 times; by which I have found from frequent experience, each ſwing then meaſured a ſecond of time, ſufficiently near for this purpoſe, even when the ſhip had ſome motion from the waves. But the beſt inſtrument for this purpoſe, as well as many other uſeful and curious purpoſes at ſea, is a good watch, or time keeper, that ſhews ſeconds, which will anſwer equally as well in a ſtorm when the waves run high, as in ſmooth water; therefore every officer that has the charge of navigating a ſhip, ſhould have one of the beſt he can afford to buy.

It is a ſufficient trial for the quarter minute glaſs, if it runs out exactly twice, for the half minute glaſs once. But after all one's care in finding out exact proportions, by which to get the true diſtance run, the whole depends chiefly on thoſe who heave the log, and hold the glaſs; neither of which ſhould be done by careleſs people; eſpecially when the ſhip ſails ſo faſt as to require to uſe the quarter minute glaſs; which will double all errors; therefore this glaſs ſhould be as ſeldom uſed as poſſible.

The Learned, as before mentioned, have very juſtly recommended to have the line that is run out above the knots, ſet down in fathoms of five feet each; being the tenth part of their 50 feet knots. The ſame exact rule may be eaſily uſed, only by having a meaſure of four feet, two inches and a half (marked on the rail, on each quarter where the log is hove) that will meaſure tenths of a mile from our 42 feet knots; which it muſt be allowed will come much nearer the true diſtance, and agree much better to the tenths of miles in the traverſe tables, than that old and bad practice of ſetting down nothing leſs than the half knots, or that more exact method of marking down to fathoms of ſix feet; and theſe tenths of a knot above or under the knot or half knot, might be very eaſily meaſured by the officer that heaves the log.

But after all the exacteſt rules, the moſt effectual method in my opinion to try what dependence can be put upon the log, and thoſe that heave it, is that I have before mentioned, if opportunity permits, clear of tides or currents, after a good obſervation had for the latitudes; that is, to allow for the variation, and ſteer due

N. or S. till a ſecond obſervation, if it can be done in a favourable time; which will give the trueſt real diſtance that can be got at Sea to compare with the Log.

On Heaving and Marking down the Log, once in two Hours only; or every Hour.

IT ſurpriſes me to find the old practice, of heaving the log only once in two hours, ſtill continued in many capital merchant's ſhips; becauſe it makes the unavoidable errors in getting the true courſe and diſtance, not only greater, but doubles them in working the day's work; and marks down not nearer than half knots of the odd line; which muſt ſtill increaſe the errors of the diſtance; for if we ſuppoſe two fathom of odd line is omitted to be ſet down every time the log is hove, it makes a difference of near ſeven miles in the 24 hours.

THIS practice lies under another great diſadvantage, which is that of not affording ſufficient room to ſet down and explain the neceſſary remarks and occurrences, that often happen in the twenty four hours.

On Heaving and Marking down the Log every Hour.

THIS practice, compared with that above, has many advantages attending it. Thoſe unavoidable errors ariſing from the wind and weather, and the ſhip's ſailing faſter or ſlower than when the log is hove, muſt be leſſened one half; and the odd line that is run out, marked down in fathoms, or tenths of a knot, every hour, muſt certainly come much nearer the true courſe and diſtance than the above old method.

BUT it muſt be allowed, that they who have been accuſtomed to the old method, may be a little perplexed in working the day's work, and reckoning thoſe odd fathoms, or tenths of a knot, that are left above the miles the ſhip has gone on any one courſe; and which is under no fixed rule; but when they amount to above half a knot, let them allow a mile; and when under half a knot, omit them, as fractions to be left, and as many other material things

things muſt be, to the judgement and induſtry of the navigator, on which depends chiefly all comparitive good reckonings.

As to the difference of trouble in this method, it ſhould not be mentioned, if it is allowed to contribute to leſſen the defects of navigation; which it certainly does; and therefore ſhould become general. I will then take the liberty to ſhew, in a day's work, my manner of keeping a ſhip's way at Sea, and which I learned firſt in the *Eaſt India* Trade; ſo that they who have been uſed to the other method, may compare and judge for themſelves.

SHIP

SHIP LIVERPOOL, through St. George's Channel, 1773.

Remarks.	H.	K.	F.	Courſe.	Wind.	Monday, March 6.
A freſh breeze,	1	5	—	S. S. W.	N.E.b.N.	The firſt part a ſteady freſh breeze, and hazy with ſmall rain; the latter part a ſtrong gale with high waves; and thick rainy weather; at 2 A. M. H. M. ſail; at 8 A. M. ſteared to the W. ward to keep clear of Scilly iſlands; at 10 lowered the T. Sails down on the caps; other remarks as per margin.
hazy with ſmall	2	3	3	——	——	
rain.	3	3	4	——	——	
	4	3	4	——	——	
	5	4	2	——	——	
	6	5	3	S.bW.½W	——	
Cloudy & thick	7	5	5	——	N. E.	
with ſmall rain.	8	4	5	——	——	
	9	5	—	——	——	
	10	6	4	——	——	
	11	6	3	——	——	Courſe with the bearings from the hill of Hoath yeſterday S. 15d. W. diſt. 176 miles, S. ing 170 miles W. ing 45 miles.
	12	7	4	——	——	
In 1ſt and 2d.	1	8	3	——	——	
R. T. Sls. and	2	8	—	S. W.	——	
Hd. Mizen T.	3	8	—	——	——	
Sl. A ſtrong	4	8	—	——	——	
gale Hd. M.	5	8	5	——	——	Latitude by account 50. 22. N.
Sail, a great ſea	6	9	—	——	——	Mer. Diſt. 0 45 } West.
and ſmall rain.	7	9	1	——	——	Long. in 7 42 }
	8	9	2	S.W.bW.	——	
	9	9	4	W.	——	
Lowered T. Sls.	10	9	4	——	——	
on the caps.	11	9	4	——	——	
	12	9	—	——	——	

Diſtance run 167 ½ miles.

The next Day at Noon.

Courſe allowed S 28d W. diſt. 110 miles
S. ing 97 miles W. ing 52.

Latitude obſerved,	48	45	N.
By Account,	48	30	N.
Meridian Diſt.	1	37	W.
Longitude in	9	1	W.

BY

BY this method, the remarks of each watch may be briefly ſet down in the margin; ſo that all that is moſt material, may be fully deſcribed in filling up the log book, or journal for the day; only leaving room at bottom for the ſhip's courſe and diſtance, and the latitude and longitude ſhe is reckoned to be in at noon; which will prove much better, for many reaſons, than that method of ſetting down the difference by longitude, to avoid expoſing how much the longitude reckoned to be in may be wrong; which by the bye can be no diſgrace to a man when he does his beſt. It is likewiſe neceſſary to draw the track of each day from one latitude and longitude to the other, with a black lead pencil, on the general chart, to compare the ſhip's ſituation with the neareſt land, or ſhoals, to prevent as much as poſſible being ſurpriſed by unexpected dangers.

ON A SHIP WHEN IN THE OPEN OCEAN.

AFTER a good look out, as mentioned in page 115, the principal dangers now to contend with, are violent winds, and waves; for which the ſhip ſhould be prepared; and every thing ſecured and made as ſnug as poſſible, according to the weather that may be expected, and as the length of the run may require. The cables may be unbent; the hauſe holes plugged up, if they lie low; and the bower anchors ſtowed ſomewhere within board; which is not only a great eaſe to a ſhip, but may make her ſail faſter, as mentioned in page 59; and may prevent the foot of the foreſail from chafing againſt the upper arms of the ſtocks, and the lower arms from plunging into the water; which may affect both the ſhip's way and the ſteerage. All top-hamper that is now unneceſſary and can be ſpared aloft, ſhould be got down and ſtowed below; ſuch as top ropes, top blocks, maules, runners, and tackles; which may eaſe the maſts, and prevent a great deal of chafing amongſt the rigging.

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IN variable winds, when the ſhip will ſail a ſlant, ſtemming near her intended courſe, it is natural to ſtand upon that tack as long as circumſtances will admit; becauſe the wind may vary, ſo as to enable you to make a ſlant on the other tack; by which a ſhip may be got ſlanting forward on her way. Then it may be worth while to carry a preſſing ſail, if it blows freſh, and ſteer by the compaſs a little from the wind, as recommended in page 151; which may contributely greatly to ſhorten a paſſage.

BUT when the wind blows ſtrong, and the waves run high near to the point of the intended courſe, ſo that nothing of a ſlant can be made on either tack; then it may be deemed very wrong to preſs and ſtrain a ſhip with any more ſail than to make her riſe and fall eaſy with the waves; for a little time, with a favourable wind, will fetch up what may be loſt by taking in ſail in good time to give eaſe to the ſhip, maſts, rigging, &c.

On taking in SAILS to ſave them, and give eaſe to a SHIP when ſailing upon a Wind in a Storm.

ON theſe occaſions, the climate, ſeaſon of the year, frequency of the wind blowing ſtrong in one quarter, and the appearance of good or bad weather that may be then expected, with all other circumſtances of the ſhip, men and materials, ſhould be conſidered, to form a judgment how to act when it comes to blow ſo freſh that the topſails cannot be carried without being reefed; and then if the top-gallant yards are up, whether it may not be neceſſary to get them down, and ſtrike the top-gallant-maſts (if they go a baft the top-maſts as mentioned page 51); and eſpecially if it is at the beginning of a long winter's night, in which time both wind and waves may be increaſed to a violent degree before morning, and which may make the ſhip pitch, roll, and labour, ſo as greatly to ſtrain every thing, and make it dangerous for the people to get them down at ſuch times: and if the wind and weather ſhould prove favourable, they may be eaſily got up again in the morning; and by this practice, at the firſt of the voyage in ſmooth water, the people will learn to be expert in getting them down or up, as occaſion may require.

As the wind and waves increaſe, a faſt ſailing ſhip, upon a wind, when preſſed with ſail, (eſpecially head ſail) will be plunged deep

deep into the ſea, and increaſe her pitching motion to a dangerous degree. This I have experienced in chaſing upon a wind, when both the pumps, and bailing at three hatchways, could not keep the ſhip free from water, till the chaſe bore away before the wind; by which movement ſhe ſoon became our prize; for we could not have chaſed her much longer upon a wind, owing to the ſharpneſs and weakneſs of our ſhip's bows, as mentioned page 22.

LET us now ſuppoſe a ſhip brought under her cloſe reefed top-ſails, the top-gallant-yards and maſts down, and every thing made ſnug, according to the appearance of ſuch wind and weather as may be expected. Getting the ſpritſail yard and jibboom in upon deck, to beat againſt weſterly ſtorms, is certainly a help, and gives great eaſe to a ſhip on ſuch occaſions. Let us alſo ſuppoſe the gale to increaſe, ſo that the ſquare-ſails muſt be taken in; in doing of which, they are very liable to be ſplit and blown to pieces by flapping, if proper management is not uſed to preſerve them; which deſerves notice: and when ſhips are known to be very labourſome, the cloſe reefed main-top-ſail upon the cap, ought to be the laſt ſail taken in; becauſe that ſail, ſtanding ſo high, contributes greatly to prevent the ſhip labouring, and is always neceſſary when a ſhip is obliged to ſcud before the wind for ſafety when the waves run high.

On taking in Square Sails upon a WIND in a STORM.

INSTEAD of the old practice of clewing up the lee ſheets firſt, (by which the leeches of the ſails flap very much) it is certainly beſt to clue up the weather ſheets, or tacks, firſt, when taking in the top-ſails or courſes; which keeps the ſails full, and prevents their flapping, till the weather bowlines and lee braces are let go, and the lee ſheets let fly; when, the ſails fly inſtantly aback of themſelves, ſo that they may be clued up with great ſafety.

EVEN this requires management at times; when, the only method to ſtill the ſail, and prevent its flapping, ſo that it may be furl'd eaſily, is to man well and haul upon the lee brails only; and only take in the ſlack of the weather brails, till the lee ones are cloſe up. For if the weather brails are too much haul'd upon, it will fill the ſail ſo full of wind, as to prevent its being furled. As to the taking in the Fore, Main, or Mizen Stay-ſails; they only require to be hauled briſkly down, that they may be furled or ſtowed away as briſk as poſſible, to prevent their flapping.

On taking in the Square Sails when ſailing large, or before the Wind, in a Storm.

WHEN the wind is on either quarter, the lee ſheet ſhould be firſt clued up; then the yard pointed to the wind; and the buntlings, &c. hauled, as much as poſſible, before the weather ſheet is let go, if the ſail cannot be backed. The wind blowing nearly along the yard, will preſerve the ſail greatly from flapping; ſo much as it would do if the yard is let lie ſquare to the wind.

WHEN the wind is right aft, one ſheet ſhould be clued up firſt: then, with the brace on the other ſide, the yard ſhould be braced as ſharp up as poſſible; haul up the bunt and leech lines, as much as they can be, before the other ſheet is let go: and if, to ſave the ſail, and things will admit, that the ſhip could be ſteered with the yard pointing to the wind, for a little while, it may contribute greatly to ſave and get the ſail ſecured.

BUT on all ſuch occaſions as theſe, and eſpecially in the night, when the word of command cannot be heard, nor can the people ſee, or be ſeen by the officers, ſo as to be directed by any means to get the duty done as it ought to be, the only method is to muſter the people altogether firſt, and make known what, and how the thing is intended to be done, and ſtation them accordingly, that none may plead ignorance in excuſe for any miſmanagement that may happen.

WHEN a ſhip will not bear to carry her courſes, it is certainly the beſt practice, firſt to ſecure and hand the mainſail (as the foreſail may be carried a great deal longer) and, with the mizen and main-fore-ſtay-ſails, a ſhip may be ſteered cloſe to the wind, ſo as to make her tolerably eaſy and lively in the ſea; and eſpecially when beating to windward in narrow ſeas, theſe are the moſt ſuitable ſails a ſhip can be under at ſuch times, becauſe ſhe may be the more eaſily and readily weared: and when the ſtorm increaſes, ſo that the ſhip will not bear to carry the foreſail, it may be taken in with great advantage in the time of wearing, by the above mentioned rules. After the people are got together, and the intended method of proceeding made known to them all, as ſoon as the ſhip is perceived to begin to wear, the yard being kept braced ſharp up, the tack and bowline may be let go, and the weather-clue garnet hauled up; and when the ſhip is nearly before the wind, the bunt and leech lines, and the other clue garnet, may be hauled up, and, if the ſituation admits, and the occaſion requires it, the ſhip may be ſteered with the wind on the quarter, till the ſail is ſecured.

ON LAYING A SHIP TO IN A STORM.

THIS is intended, as much as poſſible, to preſerve a ſhip from the dan erous effects of violent wind and waves, by endeavouring to ſteady her from labouring, and make her riſe and fall with the waves as lively, and eaſy in the ſea, as poſſible; and the beſt method for doing this, I can aſſert from long experience, is, for the ſhip to be under her lower or ſtorm ſtayſails, with the mizen reefed, and balanced, &c. and the yards braced full, as repreſented in plate 6, fig. 2, and not by the common method of laying a ſhip to, under a reefed or a whole mainſail, with the foreſail aback in the brails, as repreſented in fig. 1, of the ſame plate.

On lying to under a Mainſail, with the Foreſail aback in the Brails.

THAT this method is far from being the beſt to anſwer the above mentioned purpoſes, may be proved from reaſon as well as experience; for if a ſhip be laid to in this manner, with

ſome ſails full, and ſome aback, and the helm made faſt a lee, as is cuſtomary, inſtead of keeping her bow to the wind and waves (which, only, can keep her eaſy in the ſea) ſhe will be conſtantly coming to the wind, ſo as to ſhake the weather leech of the mainſail by her head-way. The foreſail being aback, and the power of the waves a head, ſoon give the ſhip great ſtern-way; and the helm being a lee, as before mentioned, makes her fall round off, four or five points from the wind, which cauſes the ſhip to labour and ſtrain in proportion as ſhe comes to and falls off from the wind, and alſo expoſes thoſe flat and weakeſt parts, the counter, ſtern, quarter, and broadſide, to bear the ſhocks of violent and dangerous waves, that ſometimes break in and do great damage; and the mainſail is often ſplit from ſuch a cauſe, as well as by the power of the wind. The quickneſs of the ſhip's rolling motion, from the aſcending to the deſcending ſide of a high ſteep wave, acts with more or leſs force, in proportion to the bigneſs of the ſails, to ſplit them.

FACTS, derived from experience, are the only confirmation of a practice being right or wrong. I was in one of our *Eaſt India* ſhips, bound home late in the ſeaſon, and was five weeks beating round the *Cape* of *Good Hope*, againſt weſterly ſtorms; when to preſerve and keep the ſhip from rolling too much, we often laid her to, under a whole mainſail, with the foreſail aback in the brails, as repreſented fig. 1, plate the 6th; when the above mentioned bad cuſtom ſplit our mainſails faſter than we could repair them, till we had none to bring to the yard, but were obliged to wait till they were mended; and they ſplit again in leſs time than was taken up in mending them; during which time we commonly laid to under the mizen, when, for want of a little more ſail to ſteady her amongſt the waves, ſhe became more expoſed to thoſe dangers above mentioned, labouring with a more quick, jerking and deeper rolling motion in the ſea; and we found the want of the mainſail (which is the moſt material ſail upon a wind) to take the advantage at ſuch times as the wind varied ſo as to enable us to make ſlants, and by which only we got round the *Cape*, after the time that is ſaid to be limited by the Company to prevent damage to their ſhips and cargoes.

FOR

On a SHIP under STORM, or lower Stay-ſails and Mizen, in a STORM.

FOR the reaſons now mentioned, after long experience, my practice has been (inſtead of laying the ſhip to in this manner) firſt to ſecure and hand the mainſail, and, if the gale increaſed, I handed the foreſail, and reefed and balanced the mizen. The mizen, main, fore, and fore-top-maſt-ſtay-ſails were kept ſet, as we might have done with the above mentioned ſhip, or ſuch another as is repreſented figure 2, in the ſame plate; where both methods may be ſeen, in order to make a fair compariſon of the two from practical facts.

On the advantages of a SHIP being kept under lower or Storm Stay-ſails and Mizen, inſtead of lying to in a Storm.

FROM what has been ſaid, it may juſtly be concluded; that a ſhip laid to with the helm a lee, muſt be conſtantly coming to, and falling off from the wind, more or leſs, in proportion to her head and ſtern-way; ſo that when a ſhip is laid to in a ſtorm, (as repreſented fig. 1, plate the 6th) and that the power of high waves are added to the wind, ſhe muſt naturally run up too near the wind by her head-way; and then both wind and waves unite to give her ſtern-way, which makes her fall round off, and throws her ſtern up againſt the wind and waves, which then act very powerfully againſt thoſe tender parts, till ſhe gets head-way again, and makes the ſhip uneaſy, and labourſome to a dangerous degree, as above mentioned; to avoid which, I ſtrongly recommend to keep the ſhip under-way, under her lower, or ſtorm, ſtay-ſails, as they may be called, with the reefed and balanced mizen ſet, and the yards braced ſharp full, as repreſented by fig. 2, plate the 6th; which will certainly contribute greatly towards producing the following advantages.

BY this method a ſhip may be kept with ſo much head-way upon her, as to be under the command of the helm, and to ſteer her nearly to a courſe, ſix points from the wind, which ought by all means to be endeavoured after, to keep her bow (that bold and ſtrongeſt part) pointing to the waves, where they can do her the leaſt damage, and which makes the ſhip at the ſame time much

eaſier

eaſier and livelier in the ſea, than being laid to as above mentioned. And theſe ſmall ſails are handy and ſtrong, compared with the mainſail, being commonly made of equally ſtrong canvaſs, and proportionably leſs liable to be ſplit, either by the wind or waves, and can be ſet, or taken in eaſily with ſafety, and they ſtand ſo flat, and fairly divided from the bowſprit end to the ſtern, as tend greatly to ſteady the ſhip, as well as eaſe all the maſts, yards, and rigging from jerking and chafing in her rolling, and to preſerve the mainſail and foreſail (the two moſt material ſails that are to be depended upon) on any extraordinary occaſion that may require their being ſet and carried, upon a wind, in bad weather.

FOR theſe reaſons, where ſhips do not wear and uſe amain and fore-ſtay-ſail in common, I would recommend to have them as ready to be bent and ſet as poſſible on theſe occaſions, having hanks upon the ſtays, and gromets upon the ſails, for that purpoſe.

On bearing away in a Storm, to ſcud before the Wind and Waves.

WHEN the waves run high, and ſudden neceſſity requires to bear away, it ſhould be conſidered, that the low head-ſails which the ſhip may be weared under, when ſhe comes before the wind, may be becalmed by the height of the waves, which may break violently againſt the ſtern, and fill the deck with water; but, that loftier ſails being ſet, would give the ſhip more way through the water.

I HAD an inſtance of this, in a cruiſing ſhip, under low ſails upon a wind in a ſtorm; when the ſhip and all things forward gave way ſo much, as obliged us to bear away before the wind; and the low ſails we had weared under, being becalmed by the height of the waves when the ſhip was in the hollow part of the ſea, the waves came running againſt the ſtern with great violence, and filled the deck with water; which frightened the people ſo, that ſeveral of them called out with tears in their eyes, that the ſhip would founder: we got the cloſe reefed main-top ſail ſet, which had the deſigned good effect to catch the wind, and always kept drawing full above the waves; this increaſed the ſhip's way ſo much, that the waves did not reach her with above half the velocity and power as before, and gave the ſhip time to riſe and fall

gently

gently with them, without ſhipping much water; for the waves I ſuppoſe might run at the rate of about twenty miles an hour, the wind going at about fifty, and the ſhip above ten miles by the log, which naturally leſſened the power and violence of the waves above one half upon the ſhip. This proves the advantage, and even the neceſſity there is for having a cloſe reefed main-top-ſail ready to ſet when going to ſcud before high waves; and ſhould be the laſt ſquare ſail that is taken in, in a labourſome ſhip.

On ſailing LARGE, or before the WIND, in SQUALLS.

PROCEEDING in ſqually weather, muſt be left to the judgment and prudence of the officer that has the command, to act as circumſtances and the ſituation of the ſhip and crew will admit, and to run more or leſs riſk, in carrying ſail more or leſs, accordingly. But this I can ſay from experience, that it is not ſufficient that a ſhip can be got before the wind at the time of a heavy ſquall with a great deal of ſail ſet, as it may endanger not only the maſts and ſails, but the ſhip may be ſo overpreſſed with ſail as to put it out of the power of the helm, and the beſt helmſman, to ſteer her from broaching to, which may prove fatal to the whole.

WHERE rules cannot be fixed, the reſult of facts from experience muſt be our only guide. I was in a ſhip in the *Jamaica* trade from *London*, where our commander would not permit any ſail to be ſhortned or taken in, without his order or conſent, when carrying a preſſing ſail, large, with a Weſterly gale. At the coming on of a ſquall of wind, he was called upon; and when he came upon deck, he took the command, and directed the helmſman to endeavour to keep and ſteer the ſhip right before the wind, without ſhortening ſail; but the ſhip was ſo preſſed with ſail, as to loſe the power of the helm to ſteer her, which almoſt proved fatal to us all.

ALL unneceſſary daring riſks of every kind, when there is no preſſing occaſion to require ſuch, ſhould be avoided and condemned as the greateſt folly; for there can be but little loſt, and a great deal may be ſaved, by lowering or taking in ſail, in good time, when a ſhip is ſailing large, or before the wind in the time of a ſquall; as ſails may be ſoon and eaſily ſet again, when the ſquall is

is over, which may be the means of preventing great loſs or damage.

AMONG many inſtances of this kind that I have known, I met with one, by the foolhardineſs of a *London* pilot, who would not let our ſails be lowered, when ſailing before the wind in a ſquall; which made the maſts bend ſo much, that when we wanted to clue down the top-gallant-ſails, and top-ſails, we could not get them down; which ſhews the neceſſity there is of clueing theſe ſails down, and ſecuring them down, and from flying up again before a ſquall comes on: for had this ſquall proved any ſtronger, or continued any longer, we muſt have loſt our maſts, in ſpite of our utmoſt endeavours.

THIS ſhews the folly of running ſuch imprudent riſks, when little or no advantage can be gained by it; for it may be a diſputed point wether a ſhip ſails any faſter for being thus overpreſſed with ſail to ſuch a dangerous degree, when ſailing large or before the wind. But a ſhip ſailing upon a wind in ſqually weather, may often be under a neceſſity to carry a preſſing ſail; yet then it ſhould be conſidered, that if the top-ſails, &c. are not clued down in good time, that the heeling of the ſhip, added to the bending of the maſts, may hinder the top-ſails, &c. from being got down in the time of a ſquall, which may prove of bad conſequence.

On ſcudding or ſailing before the WIND in a STORM.

MANY precautions are neceſſary on this occaſion. Every thing abaft, and about the mizen-maſt, ſhould be taken in, and ſtowed away as ſnug as poſſible; and I have known the mizen gaff lowered cloſe down on the occaſion.

IF the waves run high, it may be abſolutely neceſſary, for the reaſons given, to have a cloſe reefed main-top-ſail ſet, though only ſcudding before the wind, for the eaſe and ſafety of the ſhip.

BUT when carrying a preſſing ſail, to make the moſt of a ſtorm, great care ſhould be taken that ſuitable ſails are only ſet; and they ſhould be trimmed to the beſt advantage, ſo that the ſhip may be kept under the command of the helm, which ſhould be ſtrictly noticed by the commanding officer of the watch: for it ſhould be conſidered, that a ſhip at ſuch times may be ſo overpreſſed, and plunged

plunged ſo deep into the ſea, forward, with ſail, that inſtead of dividing the water on each ſide, in an eaſy manner, the full parts of the bow, and other ſtops not deſigned to be in the water, drive a great body of water above its natural level before her bows, which may increaſe the reſiſtance a head to ſuch a degree, as will rather decreaſe than increaſe the ſhip's head-way, and that in proportion to this riſe of water; and the ſtern being lifted up as much as the head is preſſed down, the helm muſt then naturally loſe ſo much of its power at the ſame time; ſo that when the wind may be going four times as faſt as the ſhip, and the waves twice as faſt, it is not to be wondered at that ſhips are ſometimes broached to, againſt the power of the helm. The remarkable loſs of the *Suſſex Eaſt-India* ſhip homeward bound from *China*, in the year 1737, firſt aroſe from her being broached to, when ſailing before the wind.

WHAT has been ſaid on this occaſion, ſhews the neceſſity for much care and pains to be taken, both by the officer and helmſman, as before recommended; and none but the beſt helmſmen ſhould be admitted to ſteer at ſuch times; and whenever danger appears from one man's ſteering, others ſhould be tried, and the ſails altered and trimmed to the beſt advantage, that if poſſible the ſhip may be ſteered without the danger of being broached to. A great riſk attends relieving the helmſman; eſpecially in the night; as he that is to take the helm, often comes but half awake from ſleep, and takes the helm without examining where it lies at the time, and how far the ſhip requires it each way to confine her to the courſe; thus, not conſidering the danger, he at firſt lets the ſhip get ſuch a ſheer, that his beſt endeavours afterwards cannot ſtop her from being broached to, or brought by the lee. To prevent which, the helmſman that is to be relieved, if he has ſteered well, ſhould not quit the helm before he has ſhewed and made known to him that is to relieve, the particulars of her trim, and how ſhe may be beſt ſteered at that time, how many turns and ſpokes of the wheel ſhe requires to ſtarboard and port, or to windward and leeward, to confine her to her courſe. On relieving the helmſman.

IT is well known, that there is a great difference in ſhips ſteering, according to their built and trim. Full built ſhips, when deep loaded, are often difficult to be ſteered, when ſailing large in a gale of wind. I have been told of ſome that could not be ſteered their intended courſe before the wind, but would broach to each way in ſpite of the beſt endeavours, ſo that they have been obliged

Hints to prevent broaching to.

to lie to with a fair wind; which has often happened to an expert dil gent officer of my acquaintance: therefore every hint that has the leaſt reaſonable appearance to remedy this evil, deſerves attention, and ſhould be tried. On this occaſion, when a ſhip cannot be ſteered right before the wind without broaching to; ſuppoſe a trial ſhould be made to ſteer her with the wind two or three points firſt on one quarter, then upon the other, for a little time each way? This reduces the danger to only being liable of broaching to, one way; that is, to windward; which may be much eaſier guarded againſt by the weather helm this one way, than both: And if we ſuppoſe the ſhip to be ſteered with the wind on the larboard quarter, with the cloſe-reefed main-top-ſail ſet and braced up with the larboard braces, and the head-ſail trimmed ſharp the other way, with the ſtarboard braces and the helm a-weather, (as repreſented in the plan of the ſhip, figure 1, plate 7,) it evidently tends greatly to counteract and get the better of thoſe cauſes, before mentioned, which occaſion a ſhip to broach to; and may keep her under the command of the helm. But if this method ſhould not anſwer, there is another which I think could not fail of ſucceſs; that is, to veer out, and tow right over the ſtern, a tow-line, or hawſer, or as much of a cable end as may be found ſufficient to keep the ſhip before the wind, and prevent her broaching to.

AT ſuch times as theſe, when a ſhip cannot be ſteered to the courſe that is ordered, it ſhould be recommended to the officer of the watch to take particular notice which way ſhe goes moſt from her courſe, to make an allowance and mark it down accordingly.

On CUNNING TO THE HELMSMAN.

THIS cuſtom is uſeful in general, even when done by a quartermaſter; it anſwers the good purpoſe to confine the thoughts and attention of the helmſman to his duty; as he is obliged to repeat the cun, though he with reaſon, (as I have often done,) moves the helm contrary to the cun, in order to confine the ſhip to her courſe, by ſuch management as before mentioned. The good helmſman, after a little experience of the ſhip's trim, muſt be allowed to know beſt what helm is required to ſteer a direct courſe.

But

BUT when ſailing is dangerous, by bad weather, ſqualls, high waves, or other dangers that may ſuddenly appear, then cunning becomes a matter of great importance; and the cun of the ſuperior officer, or who he may appoint, ſhould only be attended to, and anſwered briſkly by the movement of the helm as well as by words, to avoid the danger, or to help to eaſe the ſhip to riſe and fall gently with the waves; as it is well known to eaſe a ſhip much in her labouring motion to luff her up with the helm a lee at the approach of a high ſteep wave, when ſailing cloſe by the wind in a ſtorm. But to ſuppoſe a ſhip ſailing two points from the wind, it is a diſpute whether it is beſt that ſhe ſhould be luffed to, or ſhould bear away from a dangerous wave, that may be obſerved coming right upon the beam.

On ſailing and Cunning, with high Winds and Waves right upon the Beam.

THIS way of ſailing, in my opinion, deſerves particular notice; becauſe it is more expoſed to danger and damage than any other way of ſailing; for a ſhip upon a wind, in high waves, is ſuited with ſail accordingly, and has ſo little head-way upon her, that ſhe may be luffed up to a dangerous wave, and by that made much eaſier. And when ſailing large, a ſhip runs from the waves and weakens its force upon her. A ſhip lying to, and driving to leeward, yields and gives ſome way to a high wave when it ſtrikes her, which may a little abate its bad effect; but when carrying a preſſing ſail with the wind upon the beam (which is common, becauſe accounted a fair wind) a faſt ſailing ſhip is reckoned then to ſail faſter through the water than any other way with the ſame wind, as ſhe does not recede from the wind or waves, and makes little or no lee-way; but this expoſes a ſhip to all the violent effects of dangerous high ſteep waves, which may ſtrike and break with their utmoſt velocity upon the broadſide to windward, whilſt the ſhip's great head-way through the water makes the greateſt reſiſtance to prevent her from yielding or giving the leaſt way to leeward. From this, and the other cauſes mentioned pages 59, when a ſhip is lifted up broadſide with ſo quick a motion, from the bottom to the top of a high, ſteep, mountainous wave, it is not to be wondered at that the ſhip, men, or materials, may receive great damage at ſuch times. And the

On the danger of this way of ſailing.

greater the ſhip, and the more water ſhe draws, the more liable ſhe is to damage; ſmaller veſſels giving more way to the waves than large ones, when ſtruck. I have been in a ſmall veſſel in company with a fifty gun ſhip that had her mainſail ſplit, and other damage done by the waves breaking on board her, whilſt we received none in the ſmall veſſel. At another time croſſing the weſtern ocean in a light merchant ſhip, with our guns (which were ſix pounders) ſtowed down in the hold upon the ballaſt for the eaſe of the ſhip when ſailing this way, a ſtroke of a wave canted our ballaſt and guns from the weather to the lee ſide of the hold, and broke the ſtanchions that ſupported the lower deck beams. Theſe and many other inſtances confirm my opinion of the great danger attending this way of ſailing.

On luffing up to, or bearing away from a dangerous wave.

On cunning and ſteering a ſhip when ſailing in this way, it may be diſputed whether ſhe ſhould be luffed up to, or bear away from a dangerous high wave approaching upon the beam. Reaſon as well as experience teaches us that the helm ſhould be put hard a-weather, to bring the approaching waves far aft as poſſible, to leſſen its force, by the ſhip's running forward and giving the more way from it, rather than to luff up with the helm a lee to meet it with ſo much ſail and head-way upon the ſhip as muſt increaſe the ſtroke of the wave, and may produce a violent and dangerous pitching motion. I had an inſtance of this when I was mate of a ſhip, and it was my watch upon deck. When ſailing in this way, at the approach of a dangerous wave coming right upon the beam, I ordered the helm hard a-weather; but my commander ordered the helm a lee; which occaſioned the wave to have the above mentioned bad effect; and though we received no material damage; yet, in my opinion, it would have been leſs hazardous to have bore away with the helm a-weather.

BUT to do juſtice on this occaſion, it muſt be allowed, that ſhips in general commonly carry a preſſing ſail in this way, and we are apt to gripe and carry the helm nearly hard a-weather, to ſteer the intended courſe; ſo that without this is noticed, and guarded againſt by the officer of the watch, by having only a ſuitable ſail ſet, and properly trimmed, it may be out of the power of the helm when hard a-weather, to make the ſhip wear faſt enough to avoid the bad effects of a dangerous wave when perceived to be coming upon the beam.

After all that can be ſaid on this way of ſailing, when the waves run high, I look upon the danger ſo great, that it ought to be

avoided

avoided as much as poſſible; and it may be commendable to alter the courſe, ſo as to ſteer with the wind and waves, either to point before, or abaft the beam; or for a time each way, if the occaſion requires that nicety.

ON CARRYING SAIL AGAINST HEAD WAVES.

GREAT caution is neceſſary on this occaſion, to prevent the damage that may be done by it, ſometimes even to pitching away the bowſprit, maſts, &c. And as the waves, in the open ſea, do not immediately ceaſe with the wind that raiſed them, but often continue to run the ſame way for a great while after the wind is changed even to the oppoſite point of the compaſs; therefore when a ſudden change of wind happens, care ſhould be taken not to be too forward in ſetting or carrying ſail, ſo as to give the ſhip too much head-way againſt the old waves, before they are fallen; as it may pitch the bowſprit under water; which I have often ſeen done to a dangerous degree. Sometimes head-waves will riſe againſt and reach a ſhip a long time before the wind that raiſed them, which may make it equally dangerous to preſs the ſhip with too much ſail againſt them.

ON LOOSING AND SETTING SAILS.

IN looſing ſquare ſails when it blows freſh, it ſhould be a conſtant rule to looſe the lee-yard arm before the weather-yard arm, to prevent the danger that the people to lee-ward are often expoſed to, of being thrown from the yard by the ſail flying up over their heads. In ſetting the top-ſails or top-gallant-ſails upon a wind, when it blows freſh, it is an approved method to haul home the lee ſheet firſt; and if the ſail be kept ſhaking by the weather-brace, the weather ſheet may be eaſily got home; but when ſailing large, the weather ſheets of theſe ſails are moſt commonly hauled home firſt. In ſetting the mainſail and foreſail, if the wind requires it, the tacks are hauled down firſt; but in box-hauling, or wearing, the ſheets may be hauled nearly aft, whilſt the

the ſails ſhake with the wind npon the quarter, and the tacks may then be got down very eaſily.

Now let us ſuppoſe, a ſhip has proceeded ſo far in her paſſage, as to draw near to danger, or to make her deſigned landfall.

On Drawing near to DANGER, or making a LANDFALL.

ON theſe occaſions, it ſhould be conſidered before hand, what it moſt depends upon, to keep clear of the danger, or to make a good landfall. If they have regular ſoundings to it at a great diſtance, then the lead may be the ſureſt guide; but if it be ſteep to, without ſoundings, then the latitude, if it is known, and a good look-out, with the ſhip properly prepared for it (as mentioned page 116) may contribute greatly towards ſafety.

WHEN going to croſs dangerous latitudes, where projecting points of land or ſhoals may lie in the way; or in making ſmall iſlands, ſuch as the Cape de Verd and Canary Iſlands; it is certainly very wrong to run without much caution in the night, or in thick weather, with a crowd of ſail, on preſumption that the ſhip is far enough to the weſtward to go clear of them, which has occaſioned many fatal loſſes, from being deceived by the conſtant Eaſterly current that runs in this track; and which in my opinion is the principal cauſe that ſhips ſo often make more longitude out than they do home, in *Weſt India* voyages, as before mentioned page 146.

IT is the latitude only when known by obſervation, and not the longitude, that can be depended upon for ſhips being near, or clear of Danger. I was in an *Eaſt India* ſhip outward bound, the Captain of which rather than run the riſk of croſſing the latitude of one of the Cape de Verd Iſlands in the night, tack'd ſhip and ſtood back to the northward under an eaſy ſail till day-light; when it plainly appeared that if we had continued our courſe to the ſouthward, we muſt have run upon the iſland before day-light.

To make a good landfall, if the ſituation and circumſtances of wind and weather permit, that a ſhip can ſail with a leading wind true Eaſt, or Weſt, to the place of the deſigned landfall, it is an approved method to get into that latitude in good time; and eſpecially homeward bound from the Weſtern Ocean; and to endeavour

endeavour by all poſſible means to get obſervations, to make proper allowance for the variation of the compaſs, lee-way, bad ſteerage, currents, or tides if known, to keep the ſhip as near as poſſible in this deſigned latitude. When got into the deſigned latitude, the uncertainty of the longitude makes the diſtance to be run uncertain: therefore in the day and clear weather, all the ſail that is poſſible with ſafety ſhould be carried; but in the night or thick weather, if it is thought prudent to run, it ſhould only be with ſuch ſails as the officer and people on deck can look round them, and work the ſhip ſo as to avoid the danger in whatever manner it may appear.

NOTWITHSTANDING theſe rules and precautions in landfalls, I have experienced very narrow eſcapes, both in *America*, and on our own coaſt, where we are very liable to be deceived by the tides; and in cloudy weather, by taking one place for another. Among many inſtances, it was my caſe in a ſhip from *Leghorn* to *London*, when in a cloudy afternoon we fell in with, and juſt got a glimpſe of the South ſide of St. Mary's Scilly Iſland; which, by our reckonings, and an account we had from an outward bound ſhip, we took for and concluded it to be the Lizard Point which we had ſeen. Therefore ordered, (as I thought we might with confidence,) to ſteer a channel courſe for the night; but our miſtaken ſituation, though in a fair line of direction with our channel courſe, occaſioned the ebb tide (that ſets N. W. between Scilly and the Lands End) to take the ſhip on the ſtarboard bow, which ſheered us inſenſibly into the bottom of Mount's Bay: about midnight we were ſurpriſed with broken water, and land extending as far as we could ſee on our ſtarboard bow, when carrying top-gallant-ſails with a freſh gale, quartering at S. W. and large ſwelling waves from the main ocean, right into the bay.

THE hurry we were in to exert our utmoſt endeavours at this critical moment, may be judged from our dangerous ſituation: we had our ſmall ſails to take in, and our top-ſails to get down, before we could bring the ſhip by the wind, to lay her head from the neareſt breakers; and we had the main and fore-top-ſails to cloſe reef; and the top-gallant-yards, &c. to get down, when we had not room to ſtand above a quarter of an hour upon a tack, clear of the breakers. This ſo alarmed ſome Engliſh paſſengers (and even one of them who had been brought up to ſea) that they all aſſembled in the great cabbin to prayers, which they thought was their only refuge for ſafety; but putting the ſhip in ſtays, which ſhe refuſed,

On turning out of Mount's Bay, and how we managed in box-hauling.

refuſed, and then wearing her round, by box-hauling, as repreſented in the two figures, plate the 7th, frightened them from prayer, and they all came upon deck, thinking we were running the ſhip on ſhore. We thus managed her by box-hauling; and as ſoon as we perceived the ſhip ceaſed from coming about in ſtays, we hauled the fore ſheet cloſe aft again, trimed the head-ſails flat whilſt the ſails were ſhaking, and hauled about the main and main-top-ſail, the ſame as if the ſhip had ſtayed; then hauled up the mized and kept the helm hard a lee, as repreſented by fig. 2, in the ſame plate; by which the ſhip getting great ſtern-way, turned ſhort round upon her heel, till ſhe filled the main and main-top-ſails the right way: we then ſhifted the helm hard a-weather, when the ſhip got head-way with the ſails trimmed, as repreſented by fig. 1, which brought her readily round, with little loſs of ground: and by theſe means, in about twelve hours we turned to windward ſo far off the lee ſhore, as repreſented fig. 3, and ſo as to weather the Lizard; where, to prevent ſuch dangers at that place as we then narrowly eſcaped, they have ſince erected light houſes; for which they have my thanks, and in my opinion deſerve the thanks of the public. The like public thanks will be due to whoever may be inſtrumental in getting a diſtinguiſhable light or lights on Holyhead, to prevent as much as poſſible ſuch fatal loſſes as have often happened in Canarvon Bay, occaſioned principally by the ebb tide taking ſhips on the larboard bow, in St. George's Channel, when ſteering from Tuſker for Holyhead, and which ſheers them inſenſibly into Carnarvon Bay, if the tide is not properly allowed for as before mentioned.

THAT a ſhip ſailing againſt a tide or current, which takes her on either bow, is the cauſe that alters her courſe, muſt be evident to every one who knows that when a ſhip is ſailing with a leading wind in a narrow river or channel againſt a ſtrong tide or current, it requires nice ſteerage right againſtthe ſtream, to keep her in a fair way; for if the ſtream is ſuffered to take her on tne ſtarboard bow, ſhe will ſoon ſheer upon the larboard ſhore; if on the larboad bow, upon the ſtarboard ſhore, &c. ſo that the ſame cauſe will have the ſame effect in all narrow ſeas, or channels, in proportion to their breadth. Where the tide or current runs ſtrong, it may be highly neceſſary in the night or thick weather, to endeavour to ſteer right againſt the ſtream, whilſt it runs againſt the ſhip, as circumſtances may require, to keep the ſhip in mid-channel, or in a fair way till day-light, or until the weather is ſo clear as

as to permit us to ſee the danger at a ſufficient diſtance to run a croſs the ſtream, boldly, for the land, to find the ſhip's real ſituation; which may be a means to avoid ſuch dangers as above-mentioned, and to proceed forward with more ſafety. Proceeding in this cautious manner, is eſpecially neceſſary in St. George's Channel, where the tides run ſo ſtrong, that when a ſhip happens to enter it, at the firſt part of either flood or ebb, if the land cannot be ſeen clear enough to make proper remarks, the tide may make vaſt alteration in the intended diſtance to be run, as well as in the courſe; by which people's judgment is apt to be miſled; and they take one place for another; which has occaſioned great loſs and damage, to my knowledge.

THEREFORE after a night's run in St. George's Channel, if the land you happen to fall in with appears dubious, to avoid any bad conſequence that may attend a miſtake, no pains ſhould be ſpared to get a certain knowledge of it. At the clearing up of a fog, I have been obliged to ſend a boat on ſhore to inquire what land it was that we found ourſelves ſo near to, and was ſurprized afterwards to find it was a part of the Iſle of Man; and we ſhould not have known it without this trouble: ſuch great alteration does the different ſtate of the atmoſphere ſometimes make in the appearance of land.

Now let us ſuppoſe a ſhip arrived ſafe to where ſhe is obliged to take in a pilot: if ſhe is to be boarded from a ſloop, ſchooner, or hoy-rigged veſſel, under ſail at ſea, in bad weather, it may be dangerous, and is often attended with damage, if not properly managed; therefore it deſerves notice.

On getting a PILOT on board in bad Weather at SEA.

THIS is ſometimes attended with ſo much danger, that the Pilots belonging to *Liverpool*, rather than run the riſk of boarding a ſhip from their own *ſloop*, ſometimes go no nearer to the ſhip than to have a ſmall rope thrown to, or veered a ſtern, to them, which they make faſt about the Pilot's body under his arm-pits; he then goes overboard into the ſea, when as near the ſhip as they dare venture, and he is hauled on board the ſhip by the rope.

It is a bad and common practice, in many ſhips, when the Pilot's veſſel has got near them, to lay the ſhip to, with the helm a lee; and to let her drive with the main or fore-top-ſail a-back; thinking they may be boarded by the Pilot's veſſel without danger. But no ſenſible pilot, that knows what would be the conſequence, will offer to board at ſuch time, whilſt the ſhip lies to. But if an unexperienced Pilot boards a ſhip upon the weather quarter (which ſeems much the beſt for the purpoſe) the ſhip then heeling to leeward, keeps the yards, maſts and rigging clear from getting entangled. Yet it is well known from experience, that it is more difficult to board to windward than to leeward; and that a ſtroke by a wave from a ſmall veſſel againſt a large one, will do much more damage, than a ſtroke by a large veſſel againſt a ſmall one; becauſe the large veſſel reſiſts, and does not give way to the blow of the ſmall one, which ſmall one would yield and give way to a ſtroke from the large one, in proportion to the difference of their weight: for which reaſon, a ſhip ſhould always be boarded on the lee ſide; but to do it whilſt ſhe lies to, is attended with too much danger to riſk, when the ſhip has any motion from the waves; for the helm being a lee, the ſhip may get ſternway, and fall round off from the wind, whilſt the Pilot's veſſel is boarding; which may occaſion great damage; and for want of a ſtern rope, I have known rowing boats, when boarding, get a-thwart the hauſe, and ſink at ſuch times.

The beſt method for this purpoſe is, when the Pilot's veſſel is got near, (but ſtill far enough to windward) for the ſhip to ſail right forward, about a point from the wind, with the after-yards braced ſharp up, the main-yard aback out of the way, and ſail enough, eſpecially ſtay-ſails, to keep good head-way upon the ſhip, the more the better, ſo that ſhe has only a little leſs way than the Pilot's veſſel, which may ſhoot up under the ſhip's lee quarter, where a ſtern rope, and one paſſed aft from cloſe forward, ſhould be ready and thrown to them; by which they may tow and ſteer their veſſel clear from damage under the lee quarter, ſheltered by the ſhip from the waves; and may watch for a ſmooth ſea, and ſheer to the ſhip, at pleaſure, to board the Pilot, and ſheer clear again with the leaſt riſk poſſible.

SHIPS ſhould have ſkilful Pilots, to take care, when among dangerous rocks and ſhoals, to keep clear of them. A Pilot's qualifications ſhould, as much as poſſible, be every way equal to the dangers and difficulties that attend his navigation; and he ſhould know where the ſhoals extend to a great diſtance; where the channels are narrow, intricate, and ſhallow; and where and when expoſed to dangerous waves, where life, as well as property are at ſtake. None ſhould be admitted to take upon them this important charge, but ſuch as, from experience and practice, can give a ready verbal account of the courſe and diſtance from one place to another; the flowing and ſetting of the tides; depth of water, land marks, buoys, beacons, lights, &c. And ſhould not only be ſeamen enough to work and manage a ſhip to the beſt advantage in fine weather, but capable, when in difficult ſituations, to form a right judgment of what is beſt to be done for ſafety, and what can reaſonably be expected for the people and the ſhip to do on every occaſion.

THE beſt and moſt dexterous Pilots for working and managing ſhips in crowded, narrow, or dangerous channels, are thoſe at *Tinmouth haven*; who, from much practice by having ſo many large collier ſhips to pilot in and out, (as mentioned page 129) are more expert than any other people that I have ſeen; and they take remarkable pains to get the ſhip ſteered to their mind; they look out ſharp, and cun the helmſman loud and quick, and make him anſwer and move the helm as the occaſion may require, to counteract as much as poſſible any motion of the waves that may make the ſhip deviate, either way, from her intended track. And when they turn to windward into the harbour, they likewiſe obſerve with great attention, and cun quick, to keep the ſhip fairly full, by the wind, with the mainſail ſet, to make her more ſure of ſtaying, and with good way upon her, to make her work the better. And when they come to, where there is not room to turn to windward, they take care to lay her head the right way, brail up the courſes, and drive to windward with the tide, even where they have little more room than the ſhip's length.

BUT when or where a Pilot his found defective in ſeamanſhip, or capacity to judge and act with ſkill and prudence, on difficult or dangerous occaſions, it is certainly the duty of the commander and proper officers to be upon their guard, and not to give up their judgment and themſelves implicitly to a Pilot, of whoſe conduct

they have no aſſurance; which has, to my knowledge, occaſioned great damage and fatal loſſes.

THEREFORE when a Pilot's capacity is not known, his behaviour, in management and deſign of proceeding, ſhould be noticed; and he ſhould be treated with more or leſs confidence, as his conduct ſeems to deſerve. And when it plainly appears that his conduct cannot be depended upon, then ſelf-preſervation, the firſt law of nature, makes it a caſe of neceſſity and point of duty for the commander to interfere with the Pilot, and to truſt to his conduct no farther than is conſiſtent with ſafety. He ſhould not be afraid of that falſe common notion, that if a commander of a ſhip interferes in the Pilot's duty, he makes himſelf anſwerable for the conſequence of the inſurers: it is quite otherwiſe; for the inſurers inſure the commander's conduct; therefore, inſtead of being blamed by the inſurers, he certainly deſerves their thanks for endeavouring to prevent loſs or damage likely to be occaſioned by the thoughtleſs blundering Pilot who has fallen to his lot; which has been my caſe, and we had a very narrow eſcape.

BUT Pilots, like other ranks of men, muſt be allowed to have different capacities and diſpoſitions; and according to their practice they muſt be more or leſs capable of their duty; conſequently, among the many, there muſt be a variety of good, bad, and indifferent. Yet the reſpectable character of a Pilot on the whole, entitles them to be treated with all the regard and encouragement their uſefulneſs deſerves. When a Pilot proves deficient in his duty, and a better is not to be had, it is certainly beſt to make the moſt of him, and to endeavour by all poſſible means, to help and adviſe with him, with temper and candour, what may be thought beſt to be done according to circumſtances: and if his ſpirits appear to fail him in a dangerous paſſage or ſituation, and no remedy left but to go forward, he ſhould then be cheered and encouraged to keep up his heart, and not to let fear, nor intoxication with liquor, get the better of him, which may be equally of bad conſequence.

BUT the moſt danger is from thoſe inconſiderate and unexperienced Pilots, who ſuppoſe a ſhip may be managed and conducted with equal eaſe and ſafety among ſhoals, as their own ſmall veſſels to which they have been accuſtomed; therefore, they think there is no occaſion to wait for the tide, the day-light, or clear weather, but to puſh forward at all hazard, though it may be ſuch weather that no lights, marks, buoys, or beacons can be ſeen,

not

nor dangerous ſhoals guarded againſt, by a compaſs courſe, nor by the lead, at a ſufficient diſtance to keep clear of them.

I HAD the experience of a Pilot of this ſort, who wanted to run in the night amongſt the ſhoals, when nothing could be ſeen for a guide to keep clear of them; therefore I oppoſed him till day-light; when it blew freſh, right upon the ſhore; with drizzling, hazy weather, ſo that we could not ſee a mile before us: he preſſed me very hard to bear away and ſet ſail: I reaſoned with him of the danger; and would not conſent till we had a conſultation of the officers. He was told of the great riſk there was in running upon a lee-ſhore in ſuch bad weather, and that if we fell in at any great diſtance from a fair way, he was to conſider that the ſhip was not to be worked and managed in little room among ſhoals, like the ſmall veſſel we had taken him from, &c. He anſwered; "that the greateſt danger was from not running to get "into ſafety when we might; and that his life was as dear to him "(having a family depending upon it) as any of ours could be to "us; and that if he could but ſee any part of the land, or even "the breakers, he could ſteer in by them, to get into ſafety."

BY the Pilot's perſuaſion, we bore away for our port; but with all the neceſſary precaution poſſible, to guard againſt the apprehended dangers above mentioned. We ran before the wind under cloſe reefed main and fore-top-ſails, thinking we ſhould be obliged to carry them by the wind, if occaſion required to make the ſhip work, or to keep clear of the lee-ſhore; the lower ſails in the brails, being ready to ſet on either tack by the wind; the anchors and cables all clear; all hands at their ſtations, looking ſharp out; and the deep-ſea lead going. In fifteen fathom water, we ſaw land, and ſhoal broken water, near a head, which were ſhewn to the Pilot, aſking him which way we ſhould go now? He pointed from the danger we were neareſt to; but looking the way he pointed, nothing could be ſeen but broken raging waves; we aſked him what was then to be done, being in five fathom water: I perceived he was overcome with fear, and had nothing to ſay, but left us to ſave ourſelves as we could. We then brought the ſhip round by the wind, and notwithſtanding we were well manned, were obliged to get the main and fore ſheet aft, with the tacks not above two thirds down; by which, under Providence, and the ſhip's faſt ſailing, we but juſt cleared the breakers on the lee-ſhore; which would by all appearance have proved our total deſtruction, if the ſhip had been left to the conduct of the Pilot,

who

who after this, as it is common with all ſuch unthinking men, went, from a raſh confidence, to ſuch extreme fearfulneſs, that he thought we could not poſſibly get far enough from the danger we had ſo narrowly eſcaped; ſo that when the weather cleared up, with a ſudden change, and a gale of wind right off ſhore, that put us under reefed courſes, we could but juſt ſee the land from the maſt head.

THIS Pilot's conduct; and the many inſtances of damage, and fatal loſſes that have been occaſioned by raſh, imprudent, and defective Pilots; prove the neceſſity that a commander may be often under, to interfere with the Pilot; but it ſhould always be done in a calm friendly manner, to adviſe and aſſiſt him in whatever he may ſeem deficient. It is but reaſonable to ſuppoſe that a commander ſhould know the trim and properties of his ſhip from experience, and what dependence may be put on her for ſailing, ſteering, ſtaying, waring, or riding at anchor, &c. as alſo how to work and manage her on extraordinary occaſions, in narrow and dangerous channels; and ſhould form a better judgment what his ſhip and crew can do, than a ſtrange Pilot who may be a clever man, and know his buſineſs as a Pilot very well; yet, for want of ſuch experience, may be much inferior to the commander in working and managing the ſhip; and when this is the caſe, it ſhould be agreed, for the Pilot to ſhew the way and point out the dangers, whilſt the commander works and manages the ſhip to keep clear of them; which, in my opinion, may often contribute greatly to prevent misfortunes. But when a Pilot is known to be thoroughly qualified to work and manage a ſhip as the navigation requires, then the commander has only to ſee that the Pilot's orders are obeyed.

WHEN ſhips are going for ſhoal flats, bar, or tide harbours, where ſafety depends upon the height and time of tide, (which makes all hints or remarks from obſervations on the tides deſerve ſpecial notice) I will venture to give ſome obſervations upon them.

ON THE TIDES.

THE tides, and the knowledge of them, are of ſuch great and important advantages to our navigation, and eſpecially among our many ſhoals, flats, bar and tide harbours, where it depends

depends entirely upon the certainty of the flow and time of the tide to proceed with ſafety, that our utmoſt endeavours ſhould be uſed to obtain the beſt knowledge of the tides that is poſſible, in all our tide and bar harbours that lie near the ſea, by obſerving and remarking the time, and how much they flow on an average, not only at full and change, but at the quarters of the moon, which is the time that the tides are at their greateſt deviation from the mean and common way of reckoning them: which, if made public, might contribute greatly to come at a more perfect theory of the tides, as well as prevent the loſs and damage that may be occaſioned by ſhips running for our ſhoal water harbours at a wrong time of tide, and being deceived by the old common method of reckoning the tides; which is very erroneous; eſpecially at the quarters of the moon. Marking the time of flowing, at full and change, always to a point of the compaſs, adds to the uncertainty of a ſhip from ſea finding the time of high water, and which from experience I can ſay has occaſioned great loſs and damage. I was in a *Weſt India* ſhip, running for a bar harbour in *Ireland*, by this erroneous rule; when, we beat off our gripe, rudder, and a great deal of the ſtern-poſt and after part of the keel, upon the bar; and had ſeven feet water in the hold, when we got into the harbour; and were obliged to run on ſhore to prevent ſinking. At *Liverpool*, I have obſerved ſhips coming in, at neap tides, about the quarters of the moon; when, inſtead of meeting with high water, as expected by the common way of reckoning, they have found it about a quarter ebb; ſo that for want of water enough, they have often ſtruck, or come aground, and lain upon the bar, when loſs or great damage has often been the conſequence.

Damage done by running at a wrong time of tide.

FOR theſe reaſons, and at the requeſt of my friend Mr. *Ferguſon*, the Aſtronomer, who with great labour and pains furniſhed me with large ſchemes, tables, plans, &c. relating to the tides in the year 1764, I began, and have continued to make obſervations on the time and heights of the tides flowing at the old dock gates, in *Liverpool*, which is about three miles from the mouth of the river, and the river ſo broad and extenſive, that as a branch of the ſea, no land floods or freſhes have any effect on the heights of the tides in the river, oppoſite to the town; and where the leaſt flow of water, that I have obſerved in neap tides, was nine feet at the dock gates, when low water was juſt even with the ſill of the gates, from whence are marks in the ſtone work, upward, 22 feet

and

and a half; from which the heights of the tides are taken; but although there are no marks below the ſill of the gates towards the river, yet from obſervations made on the whole riſe on ſome tides, I have reaſon to conclude, that in moderate weather, in proportion as the tides commonly riſe above the ninth feet mark at the gates, they fall below the ſill of the gates; and that the four feet and a half mark is near the half flood mark, let the riſe be what it will, though it does not agree with half the time of flowing or ebbing of the tides.

A middling tide nicely obſerved.

BUT to obſerve more exactly the whole riſe of one of our middling tides, I had a board fixed upright at low water in the river, marked with ſix inch marks, each foot, and high enough to obſerve by, till the tide reached the dock gates; and then remarked the time it flowed to each foot the riſe of the whole tide, which was 22 feet and a half, from ſeven feet below the dock gates, to the 15 feet and a half mark at the gates, in five hours fifty minutes. The firſt half tide roſe in two hours forty minutes; but the next to high water was three hours ten minutes: ſo that the firſt half tide roſe in fifteen minutes leſs time than the laſt; and it fell again to the half flood mark in about fifteen minutes leſs time than it was in riſing. But the ſlack tide at low and high water, muſt be allowed to account for part of theſe irregularities. It ebbed the tide before, (as I judge it does moſt commonly in moderate weather) ſix hours thirty minutes; which, added to the flood, five hours fifty minutes, makes twlve hour twenty minutes. The twenty minutes difference in time between theſe two high waters, agrees with a tide table that is calculated and publiſhed here yearly by Meſſrs. *Holdens*: the benefit of which will be mentioned hereafter.

Shape of the waves of the tide.

I HAD the above tide drawn into a ſcheme, dividing the feet the water roſe and fell, by the minutes of time. The wave of the tide, as it may be called, formed a curve near the parabolic, or the range of a bomb ſhell (only ſpread out at the bottom) as the firſt and laſt half foot in flowing took about thirty minutes, varying by degrees faſter and ſlower to half tide; when, it flowed the faſteſt, a foot in about ten minutes of time.

The tides flowing compared with a tide clock.

THE old method of reckoning the tides, by mean or equal difference of time, or the bearing of the moon by the compaſs, from full to change, has been found very defective. I had a tide clock made, that was planned by Mr. *Ferguſon*, to ſhew the time of tide by this rule. I kept the clock going as near as I could do to ſolar time; and what proved very remarkable, was, that at the quarters

quarters of the moon, when it was really high water by the tide, the clock commonly ſhewed only three quarters flood; ſo that, from the full and change, to the quarters of the moon, the time of high water commonly loſt near a quarter of a flood, or above an hour from regular time.

Tides higher and lower in proportion to the moon's diſtance and declination.

MANY laudible attemps have been made to fix eaſy rules to agree with the deviations abovementioned; which, it muſt be allowed, would be a great improvement in reckoning the tides: yet I have learned from experience and obſervation, that, to come near the truth, nothing leſs will anſwer than calculating the attractive powers of the moon and ſun, according to their diſtances and ſituations from us; which makes a great difference, and brings on both ſpring and neap tides ſooner or later, and alters their heights, as well as the times of high water. Even at full and change of the moon (the only ſtated times) they will vary fifteen minutes, though all proper allowances may be made of two minutes of time for every hour the full or change happens to differ from the ſtated time of high water.

As we move round the ſun, and the moon round us, in elliptical orbits; and as the moon's motion is faſter or ſlower as ſhe is nearer or farther from us, (which is reckoned to be about 34,000 miles nearer to us when in her perigee, than when in her apogee, and thirteen days and a half in going from one to the other) that makes the high and low tides conſtantly vary accordingly; and this ſeems to me to make about a ſixth part difference in the height of the tides from what they may flow in common; which I reckon to be about twenty eight feet, the whole flow of our common ſpring tides, when we have about eighteen feet at the abovementioned dock gates: but when the moon happens to be in her perigee at full or change and great northern declination, then we have about twenty one feet at the gates. When this happens at the quarters of the moon, inſtead of twelve feet, as is common at neap tides, we have about fourteen feet at the gates. And when it happens at equinoctial ſpring tides, we have about twenty two feet at the gates; and the neap tides are low in proportion, if the moon happens to be in her apogee. And what is very remarkable, that from about the tenth of *May* to the tenth of *November*, the night tides that flow from ſix in the evening to ſix in the morning, run the higheſt; and from the tenth of *November* to about the tenth of *May*, the day tides run the higheſt; and this difference often amounts to eighteen inches.

When the day and night tides run higheſt.

Why the tpring and neap ſides come ſooner or later.

WHEN the moon happens to be in her perigee, at the quarters, it makes high neap tides, as before obſerved; the ſpring tides following, put up early; and the higheſt tide is often on the full or change day. But when the moon happens to be in her apogee, at the quarters, the following ſpring tides are late in putting up, and are not at the height till the third or fourth day after the full or change; and all the other intermediate tides are influenced in the ſame manner, according to the moon's diſtance and ſituation, and as ſhe is going farther from, or coming nearer to us, in her orbit; all which deſerve notice on many occaſions; eſpecially when there may be a doubt of a ſhip's having water enough to anſwer her purpoſe.

The progreſſive difference of the time of the tides flowing.

THE times of the tides flowing, and the progreſſive difference of time between one high water and another, are likewiſe obedient to the laws of the ſame powers. For when the moon happens to be in her apogee at the full or change, then her motion in her orbit is ſloweſt; ſo that for five or ſix tides, afterwards, the progreſſive difference of time between one tide and another is only about fifteen minuets, till they loſe about an hour from equal time; then they alter nearly to equal progreſſive time of twenty five minutes, each tide, to the quarters, when they flow about four o'clock, whether the quarters are long or ſhort, almoſt as near a ſtated time as they flow about eleven o'clock at full and change. After the quarters of the moon, the progreſſive time of flowing begins to increaſe forty five minutes each tide, till they fetch up the loſt hour, and come up to equal time about ſix tides before the full or change; which ſix tides only agree near with the abovementioned tide clock, differing each tide about twenty five minutes till the full or change, when they begin to make their deviations again as above deſcribed.

Holden's Tables for the time and height of the tide's flowing.

BUT the ingenious mathematicians Meſſrs. *Richard* and *George Holden*, from obſervations here, and ſome at *Briſtol*, have formed a theory and accurate method, whereby they calculate and publiſh, yearly tide tables, to ſhew not only the *time*, but the *height* of the tides flowing at *Liverpool* old dock gates, which I can ſay from experience agree ſurprizingly near to obſervations. Therefore I take the liberty to give the principal part of the preface to the tide table for 1773.

"A PERFECT theory of the tides, and an accurate method "of calculating them, has been greatly wanted in every age ſince "navigation was firſt practiſed; and, though induſtriouſly ſought

"after

" after, has hitherto baffled the reſearches of the moſt learned. " And as their theory has hitherto remained defective, ſo their " methods of calculation, founded thereupon, have ſucceeded no " better; for, as I am now furniſhed with about 3000 obſerva- " tions made upon the tides at *Liverpool*, and 360 at *Briſtol*, with " which I can compare my own, and all other methods of cal- " culation, I think I may venture to aſſert, that all the methods " given us in books of navigation, and all the tide tables inſerted " in our almanacks, are very frequently ſubject to the error of an " hour, and many times as much more; except that of *Monſieur* " *de la Caille*, which yet is often liable to an error of forty minutes, " as any perſon will find who takes the trouble of making a " ſufficient number of obſervations.

" INDEED no perſon can expect it ſhould be otherwiſe, who " conſiders that *Monſieur de la Caille*'s, and all other methods (ex- " cept that of *Monſieur Caſſini*, which in truth is no better) " depend entirely upon the moon's age, or her diſtance from the " ſun; without reguarding the different diſtances of either the ſun " or moon from the earth, their declinations, the latitudes of " places, or any thing elſe that affects the tides.

" THUS deficient are all former methods in computing only the " times of high water; as for the heights, the calculation thereof " has never before been attempted by any one, that I know of; " though they are, as I apprehend, equally neceſſary; for of what " advantage can it be to the ſeaman, to know when the tide, will " be at the higheſt, if there will not be, at that time, depth of " water ſufficient for his purpoſe? Indeed it would be of no more " ſervice to know that there would be depth enough of water, " unleſs he knew at the ſame time, when to expect it. But to " know what height the tide will riſe to, and at what time, muſt " contribute greatly to his ſecurity: and is it not abſolutely " requiſite, that a tide table ſhould inform him of both theſe?

" IF any perſon ſhould think proper to compare this table with " his own obſervations, he ought always to ſet his watch right im- " mediately before, by ſome good ſun dial; for theſe calculations " are made according to ſolar time.

" AND if the watch can be thus truly regulated, I doubt not " but that they will be found to correſpond very nearly with the " obſervations, as this table is compoſed with the ſame care and " exactneſs as the laſt, I having had the aſſiſtance of Mr. *Bryan* " *Waller*, through the whole work.

"INDEED it cannot rationally be expected that any method of "computation can perfectly agree with the tides, becauſe they are "ſubject to various alterations from the wind. Yet notwithſtand-"ing all the irregularities cauſed thereby, the heights given in the "laſt tide table, have agreed with the obſervations (upon an "average) within ſeven inches; and the times within five minutes."

GEORGE HOLDEN.

Advantages of theſe tide tables.

NOTWITHSTANDING gales of wind affect the tides, I obſerve it is more in height than in time, that they are made to differ from theſe tide tables; and then an allowance may be judged of according to the ſtrength or velocity of the wind blowing for or againſt the courſe of the flood tide (which here blows from the ſouth weſt quarter) and, which we may ſuppoſe, may increaſe the height of this tide above the theory, about an inch for every mile of the wind's velocity above a freſh breeze of about ten miles an hour; and may decreaſe the height in proportion as the wind blows from the North Eaſt quarter.

So that theſe tide tables muſt certainly be of great utility to all that are concerned in the time and height of the tides flowing; and from their height, may judge of their velocity, which, I reckon, oppoſite to the town, is at the rate of about a mile an hour for every fathom it flows up and down, and that is about two and a half at common neap, and about four and a half at common ſpring tides; and there is ſeven feet more water on the bar of the common channel, than at the old dock gates, and about twelve feet water at half tide, at all tides, both neap and ſpring tides; ſo that by the tide table, it may be judged when ſhips will have water enough to get into the river, and into the dock with ſafety: as alſo how to birth them according to their draught of water, not only in the wet docks, but in the graving or repairing docks; which are of different depths, that they may have water enough to get out as well as in. And the tide table is thought to be of that importance to our Pilots, that the laws for regulating the Pilots, make it a penalty of five pounds for a Pilot being without a tide table, and a watch kept to ſolar time.

I HOPE therefore theſe tide tables will meet with all the encouragement, that the author's ingenuity and labour deſerve, to continue their publication, till time gives them a fair trial how near their theory agrees with our ſhoally, dangerous ports or places, the ſafe navigation of which depends upon knowing the certainty

of

of the time and heights of the tides flowing; which may be a means to recommend ſuch tide tables to be tried and uſed in proportion to the advantages that may be experienced from them. But till time brings this about, the only method to judge when the tides will be higher or lower than common, is, to attend to the moon's diſtance, being near her perigee, or apogee, and declination, (as before mentioned) which are remarked in the nautical or *White*'s almanacks; and ſhould be in all our navigation books; where the flowing of the tides are remarked. We ſhould make an allowance, when a ſtorm of wind happens to blow near to or againſt the direction of the flood tide; which I have obſerved to make an alteration of about three feet in the height of the tides, when I judged the wind to be blowing at the rate of about forty-five miles an hour. I cannot perceive, as has been imagined, that the tides are affected when our neighbouring worlds are paſſing near us on the ſame ſide of our orbits, as mentioned in page 121; or by the different weight of our atmoſphere, as ſhewn by the barometer. And as I live fronting, and but fourteen yards from the dock gates abovementioned, (which open with the flood, and ſhut at high water) whilſt I am able to purſue ſuch inquiries, ſhould be glad of any direction, rules or hints, that might improve obſervations on the tides, to make them more uſeful to ſeamen, Pilots, Mathematicians, Aſtronomers, or Philoſophers.

The moon's diſtance to be attended to for the height and ſtrength of the tides.

To make allowance for the wind being for or againſt the flood tide.

On Ripplings or Races that run at the Edge of ſtrong Tides.

THESE waves riſe perpendicularly, very quick; and run in a confuſed manner, in all directions; and fall with ſo ſwift a motion up and down, as make, in ſome meaſure, temporary vacuums in the air, that interrupt the natural courſe of the wind; which keeps a ſhip the longer among theſe tumultuous waves, that toſs her about with ſuch violent, confuſed, diſtreſsful motions, as immediately to ſtop her way through the water, and prevent the power and action of the helm; and though there may be a freſh of wind yet make the ſails flap to the maſts, the ſhip does little more than drive along with the race of the tide. Theſe races, therefore ſhould, as much as poſſible, be avoided, as dangerous; eſpecially to open veſſels; and as I have experienced, in paſſing one in a ſchooner rigged veſſel, when we ſhipped ſo much water as nearly

nearly to ſink us before we got through it. But, when a veſſel *muſt* paſs them, it is beſt to do it with the wind large, to get the ſooner through. I knew a ſhip of 300 tons, that fell into one, off the iſland of *Uſhant*; by which they had their two boats waſhed off the deck, and loſt; and which did a great deal of other material damage.

On a SHIP at ANCHOR waiting for the TIDE.

WHEN a ſhip lies near ſhoals ſhe is to paſs or go over, I have known great advantages in obſerving the ſhoals at low water, and the flowing of the tide by the lead; and by comparing theſe with the ſhip's draught of water, they will help to form a judgment when a ſhip will have water enough.

WHERE different remarkable objects and marks can be ſeen and diſtinguiſhed as the tide flows up to them, and that may correſpond or compare with the height of water on the bar or ſhoal that the ſhip is to go over, they ſhould be remarked in the draught of the place; as may be ſeen in the inſtructions at the bottom of the chart of the bay and harbour of *Liverpool*; where there are eight different remarks for that purpoſe: but the beſt method is, where diſtinct ſignals are made by colours, or lights, on ſhore.

ANOTHER remark, from obſervation, on the tides, deſerves particular notice here; that although the high and low water marks are always varying, yet the half-tide-mark, three hours before and after high water, is very near the ſame, when we have about twelve feet water over the ſhoaleſt part of our bar, in a fair way, in coming to *Liverpool*, in neap as well as ſpring tides.

On Buoys, Land-Marks, and Light-Houſes, to avoid Dangers.

THE real advantages and diſadvantages attending theſe important objects, cannot be known but by obſervations, to make fair compariſons and improvements of them.

THE lighter and cheaper they can be made and laid down, to anſwer their important purpoſes, the better.

To begin with the *Stones* to which the buoys are moored. Inſtead of a large iron bolt, going quite through them, we only fix *Lewiſes* in them, ſuch as are uſed in hoiſting up large ſtones for buildings, run in with lead. The chains, for ſake of lightneſs, we make of a long eye-bolt-link of eighteen inches, and a ſhort oval link of ſix inches, alternately. And the buoys, inſtead of being all made in the ſhape of *Can-buoys*, with wood battens and long heavy iron ſtraps from the collar acroſs the broad end, (which makes them ride heavy and deep, and in caſe of any of the hoops, &c. giving way, the buoy muſt be ſtripped from end to end) they are now found to ride much eaſier, lighter and more buoyant, by having only a ſhort ſtrong eye-bolt of about eighteen inches long, through a ſolid piece of wood, formed like a cone, or conical cap, made like a dovetail, to fit exactly a deep chine of nine inches, made for the purpoſe, at the ſmall end of the buoy; which is found ſufficiently ſtrong, not only to ride with, but to bear ſhips getting foul without injuring them, or their giving way. And as ſhips have been often loſt by going on the wrong ſide of buoys, they may be much better diſtinguiſhed from each other by the ſhape of their upper ends, than by different colours.

THEREFORE, ſuppoſe it was made a rule in going to all ports, to have *Can-ended-buoys*, to be placed on the *ſtarboard* hand, and *Caſk-ended-buoys* on the *larboard* hand; which varieties, I can ſay from experience, may be perceived at a good diſtance; not only from the ſhape of the buoys, but, the Can-boy, from its broad, heavy end, ſwims moſtly upon its ſide; while the Caſk-ended-buoy, being ſo much narrower and lighter at its upper end, ſwims much more upright and buoyant in the water; which will direct on which hand they ought to be paſſed for ſafety.

WE have alſo ſmall buoys about three feet long, with ſmall ſtones and chains in proportion, ſhaped as above, called ſhifting buoys; to be laid and ſhifted to dangerous ſhifting ſpits of ſand that come a dry, and as other occaſions may require. As to diſtinguiſhing buoys by the colours of black and white; I think theſe colours are difficult and very uncertain to be perceived in the different ſtates of our air; and white buoys are bad to be ſeen among broken waves. From many trials I have made of all the principal

principal colours, *red* is the moſt ſtriking, and beſt to be ſeen on *Buoys*, as well as *Land-Marks*.

ON LAND-MARKS AND LIGHT-HOUSES.

THOSE that are for leading marks to avoid dangers, and to be erected near the ſea ſhore for this important purpoſe only, ſhould be made to differ as much as poſſible in appearance from other common buildings. And if there are Charts of the place, their likeneſs ſhould not only be laid down in minature, in their real ſituations, with compaſs lines of direction leading to them; but alſo in large figures, with their heights in feet, in vacant parts of the Charts; that ſtrangers may know them, and their intended purpoſe the better; as is done in our Charts of *Liverpool*; and where the fronts of the *land-marks*, towards the channels, are painted *black*, *read* and *white*, in large diviſions, that they may be the more ſurely diſtinguiſhed in the different ſtates of the atmoſphere and weather.

ON LIGHT-HOUSES IN GENERAL.

AS many valuable lives, and great property, often depend upon the certainty of ſeeing theſe lights, at a ſufficient and proper diſtance, no pains or expence ſhould be ſpared to make them as perfect as poſſible, to anſwer their deſigned purpoſe; eſpecially where there is a ſufficient fund allowed to ſupport them; or where the increaſe of trade or ſhipping make large profits ariſe from them. It well deſerves the attention of the public, to get our light-houſes improved upon the beſt plan, for the greater ſafety to ſhipping, and conſequent advantages to all concerned therein.

Uncertainty of open fire lights.

IT is well known, from reaſon as well as experience, that an open coal fire light, expoſed to all winds and weathers, cannot be made to burn and ſhow a conſtant ſteady blaze to be ſeen at a ſufficient diſtance with any certainty; for in ſtorms of wind, when lights are moſt wanted, theſe open fires are made to burn furiouſly, and very ſoon away, ſo as to melt the very iron work about the grate;

grate; and in cold weather, when it ſnows, hails, or rains hard, the keepers of the lights, not caring to expoſe themſelves to the bad weather, are apt to neglect the fire till it is too low, and then throw on a large quantity of coals at once, which darkens the light for a time, and till the fire burns up again; and in ſome weathers it muſt be difficult to make them burn with any brightneſs. And when they are incloſed in a glazed cloſe light-houſe, they are apt to ſmoke the windows greatly, nor do they afford ſo conſtant a blaze as oil lamps, with reflectors behind them, which we have adopted at *Liverpool*.

On Light-Houses, with Oil Lamps, and Reflectors.

Advantages of lamp lights.

IT is well known from experience that our common ſtreet lamps, when the oil is good, will burn a long winter's night of ſixteen hours, without any attendance, and conſume but very little wick; which plainly proves them the moſt certain, conſtant, ſteady and uniform lights, that can be uſed in light-houſes, to direct ſhipping in their paſſage through dangerous and narrow channels, as at *Liverpool*; which being ſituated in a deep, dangerous bay, with ſhoal ſand banks at a great diſtance from the ſhore (as may be ſeen by the Chart) lies open and expoſed to the moſt current ſtorms of weſterly winds, and to ſtrong tides, which raiſe high and dangerous waves; and which occaſioned many great and fatal loſſes before the year 1763; at which time four light-houſes were erected; two large ones, called the ſea lights, leading through the channel out to, and in from ſea, till the two leſſer *Hoylake* lights are brought in a line that leads into a very good road-ſtead to lie in, till it is a proper time and tide to proceed to *Liverpool*; as may be ſeen by the Chart. The loſſes have been very few in compariſon to what they were before theſe light-houſes were built; which prove their great uſe to the trade of this place for ſafety as well as expedition, in getting out and in by them. They are built from twenty five to one hundred and one feet high, as the ſituations and neceſſity required; two of them being a great height above the level of the ſea, as the curvature of our globe requires, according to the rules laid down in ſeveral of our navigation books, which ſhould always be in proportion to the diſtance of the ſhoals from the light-houſes, which ſhould be ſo high as to appear and

Liverpool light-houſes.

be ſeen above the horizon from a ſhip's deck at a ſufficient diſtance without the ſhoals, ſo that her ſituation may be known by the lights being open or nearly in a line, either to run in, or to get and keep the ſhip off by them in a fair way, as the occaſion of time and tide may require.

Lamps & reflectors, how made and fixed.

THESE lamps, and reflectors, as repreſented in plate 10, fig. 1 and 2, are fixed in the *light-room*, right fronting the channel, or line of direction for a fair way, and oppoſite the middle of the window, which is high enough in proportion to the reflector, and extends in width, each way, as far as the light can, or may require to be ſeen.

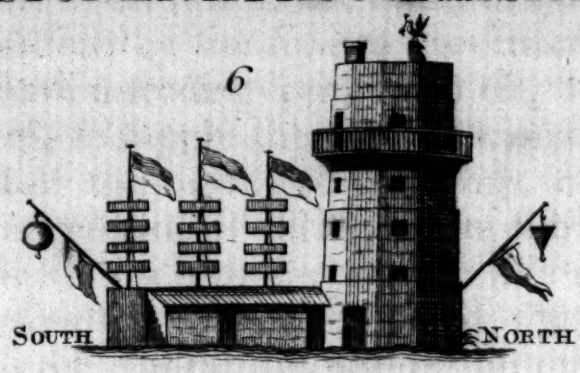
THESE reflectors are made, as near as can be, to the parabolic curve; thus: draw a ſet of parallel lines right a croſs the focus or center line; mark the focal diſtance above the parallel lines, and take an extent from the focal diſtance, to each parallel line, one after the other; with theſe extents, mark each parallel line in its turn, from the focus or burning point, with dots on each ſide of the focus line, to the extent of the deſigned diameter, and make a regular ſweep from dot to dot, as repreſented in plate 10, fig. 3; by which method a form may be made, for the curve of a parabolic reflector of any focus or diameter, to have the property, when the ſun's, or any other ray of light or fire come upon them in parallel lines they are reflected to, and croſs each other at the focus; which makes the focus the burning point; and juſt the contrary effect takes place, when a burning blaze of fire or light is fixed in their focus, all the rays of light that fall upon them are reflected right forward in parallel lines, with more or leſs power in proportion to the luſtre or brightneſs of the reflectors, which are illuminated ſo as to look like a blaze as big as the reflectors themſelves, to people in that quarter nearly facing their axes, by the angle of reflection being equal to the angle of incidence.

WE have made, and in uſe here, at *Liverpool*, reflectors of one, two, and three feet focus; and three, five and a half, ſeven and a half, and twelve feet diameter; the three ſmalleſt being made of tin plates, ſoldered together; and the largeſt of wood, covered with plates of looking glaſs, ſhaped as repreſented by fig. 1 and 2, plate 10, and fixed as near as can be to the abovementioned rules: the lamp or ciſtern part is of copper, for the oil and wick behind the reflector, ſo that nothing ſtands before the reflector, to intercept the blaze from acting upon it, but the tube that goes through it, with a ſpreading burning mouth-piece, to ſpread the blaze of the lamp parallel to

the

BIDSTON LIGHT HOUSE and SIGNALS

6



Vessels coming in

For every
- Ship ..... aBoard on the South Flag Staff
- Brigg ..... Do ..... on the Middle Do
- Snow Ketch Hoy or large Schooner ..... Do ..... on the North Do

For more than four Vessels of one kind a Flag on ye Proper Staff

SIGNALS of DISTRESS

For Vessels in Distress or on shore in ye Rock Channel or about Hoyle

coming in

On the Oblique Pole to the Southward of the Light House

For every
- Ship ..... a Ball with a Flag half Mast
- Snow ..... a Cone broad end up & a Flag half Mast
- Brigg or small Vessel Do ... small end up & a Flag Do

Going out

The same as above but a broad Pendant instead of a Flag

IN FORMBY CHANNEL

coming in

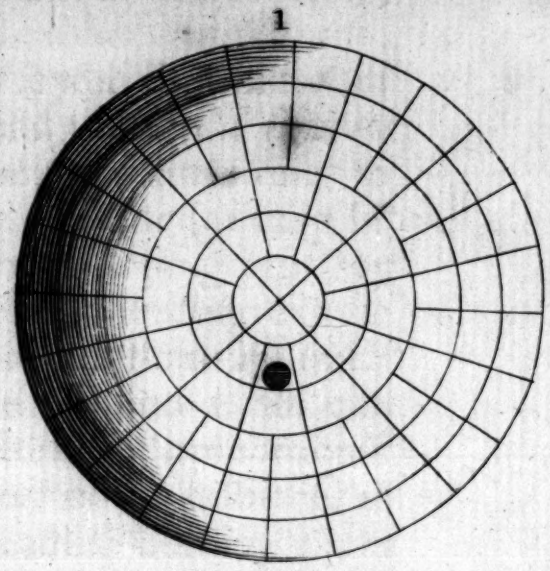
On the Oblique Pole to the Northward of the Light House

For every
- Ship ..... a Ball with a Flag half Mast
- Snow ..... a Cone broad end up & a Flag half Mast
- Brigg or small Vessel Do small end up & a Flag Do

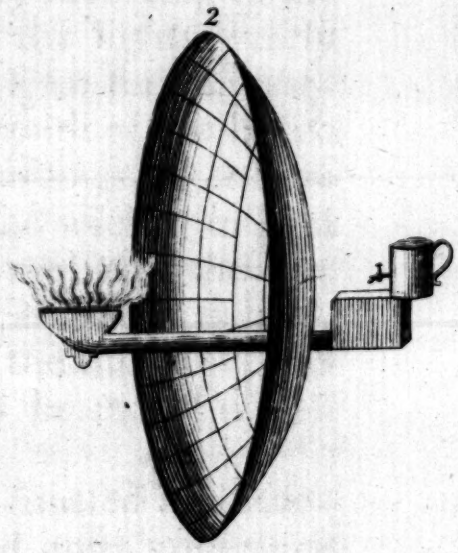
Going out

The same as above but a broad Pendant instead of a Flag

1



2

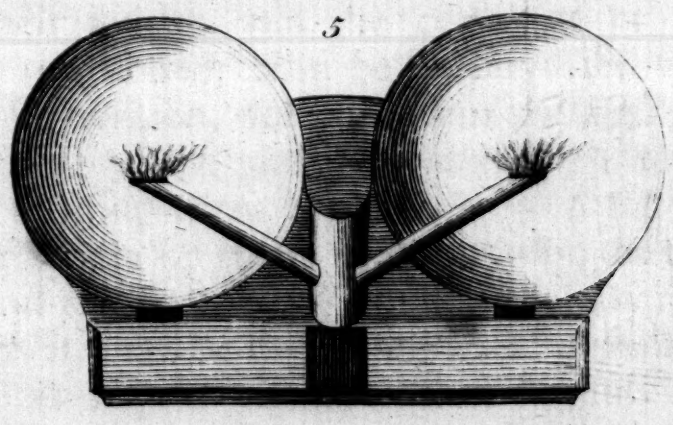


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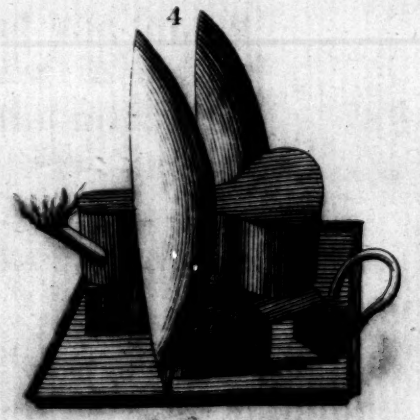


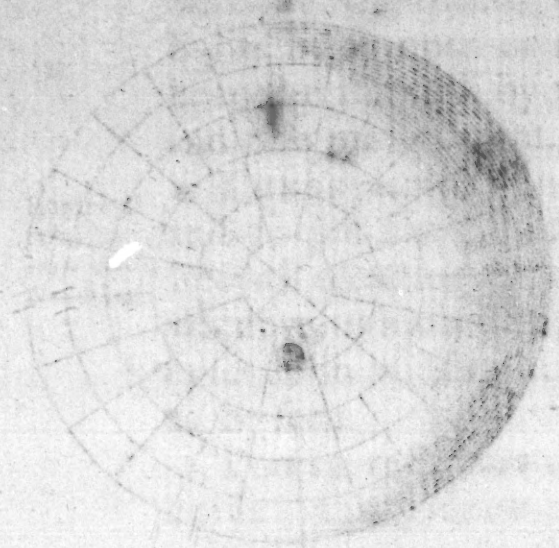
Focus

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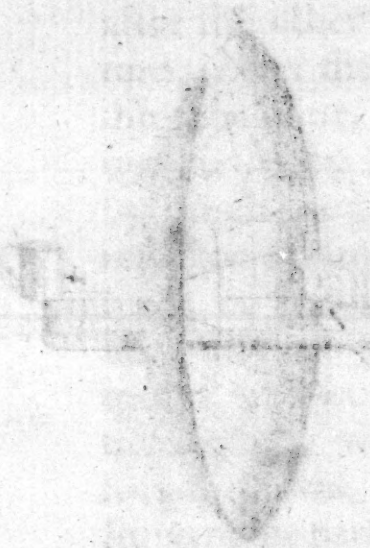


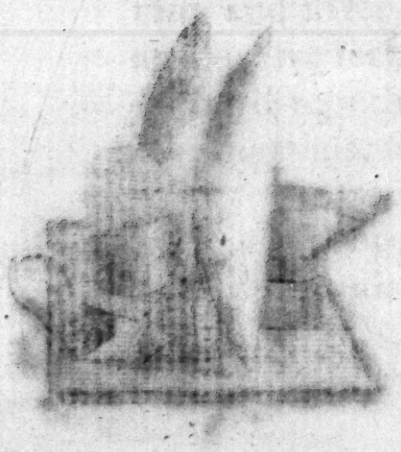
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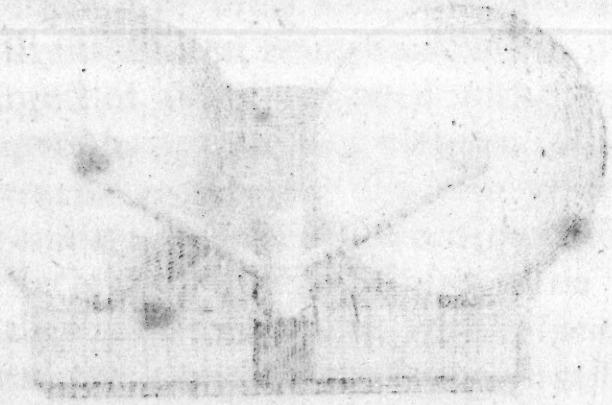












the middle of it, juſt in the focus or burning point of the reflector, as may be ſeen by the figures abovementioned.

We have a feeding-can, with oil, to ſtand upon the ciſtern of each lamp, to ſupply the conſumption of oil, and to keep it near to the level of the mouth of the lamp, near which is a little rim, to prevent any drains of oil along the tube to the reflector (as may be ſeen in fig. 2,) which drops from the rim into a dripping pan that ſtands below the reflector; and if the cock of the feeding-can be turned to run too faſt, to prevent an overflow of oil, there is a ſmall hole, and a tube in the ciſtern, that lets the oil into a tin can ſtanding below it. The lamps, like the reflectors, are proportional in their bigneſs, to make a greater or leſs blaze, as the diſtance, at which they are to be ſeen, requires; their ſpreading burning parts are from three to twelve, and fourteen inches; which makes the blaze the ſame breadth, and burns higher or lower, according to the quality of the oil, on which the goodneſs of the lights greatly depends. The wick is common cotton thread, ſpun for the purpoſe of lamps, and wound in lengths to fill the mouth of the lamps about a quarter of an inch thick; and, as it conſumes, there are long mouth-pincers, adapted to the lengths of the wicks, to haul out the wicks through the tubes, as the occaſion requires: they are ſnuffed with a pair of ſheers in one hand, whilſt a tin box is held, with a little water in it, in the other, to receive the ſnuffings, and prevent the danger of fire; and they require to be attended and trimmed by their keepers, every three hours.

These light-houſes, conſtructed, kept, and ſituated as abovementioned, have ſtood the teſt of a fair trial; and great preference and advantages have been allowed them, even by their oppoſers; for ſuch there always will be to new things; commonly calling them new whims; till time and trial confirm them uſeful improvements; which theſe are confeſſed to be by all that have ſeen them; for in a dark clear night, the two ſea lights (notwithſtanding their height, and the curvature or roundneſs of the ſea, as before mentioned, may be plainly ſeen when they are in a line with the horizon, not only from the deck, but from the maſt head of a ſhip, which gives the advantage to ſee which way they are open, to bring them in a line in good time, either to keep the ſhip off, or to run by them in a fair way, as the circumſtances of the time and tide, prudently conſidered, may require.

But it may be ſaid, that theſe reflecting lights only ſuit ſuch places as require them to be ſeen only from *one quarter* of the

compaſs; which muſt be acknowledged, though two of our lamps give a blaze twelve and fourteen inches ſquare, and there is but little reflected light above three points of the compaſs each way; but then, it muſt be allowed, that the blaze of the lamps can be ſeen as in common with other lights, above *half* the compaſs, clear of the edge of the reflectors, which will illuminate the atmoſphere fronting them, ſo as to add greatly to the light, even in that ſituation.

Light-houſes requiring to be ſeen more than half round.

A LIGHT-HOUSE that may require to be ſeen above one half, or 3-4ths of the compaſs, may be fixed, upon this plan, with two or three reflectors; one to face each quarter; and to have the tubes for the lamps from one ciſtern; or to ſerve a parcel of ſmall lamps, with reflectors of four inch focus, and eleven inch diameter; as repreſented in plate 10, fig. 4, 5: which may be ſet upon ſhelves in rows very near the window; the upper row neareſt; and thoſe below, a little behind, to prevent thoſe below from ſmoking thoſe above them: by ſuch means the rays of light that would go towards the land or againſt a dead wall, where they are not wanted, are reflected forward to add to the light that goes towards the ſhipping, for which they are deſigned.

On hand lamps and reflectors.

BUT where a light-houſe requires to be ſeen equally from all quarters quite round the compaſs, and lighted with a number of candles, or common lamps; (as it is known from experience, that rays of light paſs and croſs each other freely in all directions, without any viſible interruption; (it becomes a diſputed point, whether reflectors, would be of any ſervice. In my opinion a number of thoſe hand lamps, with reflectors ſet round upon ſhelves near the windows, as abovementioned, would reflect many rays of light in a horizontal direction, clear of the ſmoke, that would fall above and below the windows, and throw more light through the windows, with, than without the reflectors, from an equal quantity of lights; but the advantage that would be gained, wants to be confirmed by experiment.*

Signals for ſhips ſeen off, and in diſtreſs.

THESE hand lamps and reflectors were contrived to make night ſignals by lights, to be ſet in the ſtaircaſe windows of our upper ſea-light-houſe, that fronts towards the town, in caſe of any veſſel being perceived in diſtreſs in the night, or when it is too

* THERE has lately been a Light-houſe erected upon the ſmall rocks at the South entrance of St. *George*'s channel, deſigned to be ſeen all round the compaſs; with the oil ciſtern in the center, that ſupplies four reflectors of 5 and a half feet diameter as repreſented figure 1, plate the 10th, and has the report of being a good Light-houſe and being ſeen all round, though the reflectors only front the four quarters.

dark

dark to ſee the day ſignals, which are repreſented with the light-houſe, fig. 6, plate 10, as they are printed upon cards to make them known; and as they have given general ſatisfaction ſince they have been in uſe, and afford information of a greater number and variety of different veſſels than any other ſet of ſignals I have ſeen, I thought they deſerved this notice. Beſides theſe public ſignals, ſeveral merchants have flag ſtaffs erected at a little diſtance from the light-houſe; ſo that when their ſhips appear with their own particular ſignals, their colours are hoiſted on their flag-ſtaffs, for their information.

The ſituation of this light-houſe is well adapted to anſwer all theſe purpoſes, from ſtanding fronting the town and docks, at three miles diſtance, upon a hill about 40 yards high above the level of the ſea at high water; which makes it very conſpicuous both from the town and at ſea; it being the firſt object that appears on ſhore above the horizon, in a fair direction for this channel, as may be ſeen by the chart.

But to return to the hand-lamps and reflectors, as before-mentioned. I tried one of them with our reflectors of three feet diameter, and one foot focus, made and glaſſed as repreſented in fig, 1, 2, but it proved greatly inferior, though it might be ſeen at nine or ten miles diſtance; and on trying them with a common ſhop lamp, with equal wicks, and ſet in different windows of the ſtair-caſe of the light-houſe that faces the town as abovementioned, I found the reflected lamp eclipſed the common lamp to ſuch a degree that I could ſee it, without uſing a ſpy-glaſs, at three miles diſtance. Theſe ſmall reflectors were only beat out of common tin; but if they were improved and made of blown quick ſilvered glaſs, ſilver plated copper, or reflecting teleſcope metal, as concave mirrors, and ſoldered all together with the lamp in a tin pan like a dripping-pan, (as repreſented in fig. 4 and 5) only with the addition of tin ſtays behind the reflectors, to keep all together in handing them about; it is a doubt with me, whether a number, ſet as abovementioned, would not be preferable to our large reflectors; for I have perceived from experience, that our large reflectors of one foot focus, and three feet diameter, reflect a ſtronger light, in proportion, than our large reflector of twelve feet diameter and three feet focus. For the quantity of light received upon any given ſurface, will decreaſe in the ſame proportion as the ſquare root of the diſtance from the luminous body is increaſed, four, eight, and ſixteen times leſs, &c. Therefore from

from all my experience and obſervations, I would recommend ſmall reflectors of 11 inches diameter and 4 inch focus, made with what is now called *Mudge's* reflecting teleſcope metal, as publiſhed in the Philiſophical Tranſactions, *December* 1777; by which I got one made and compared with one of the ſize and focus, in a nice manner, glaſſed with ſix ſided quick ſilver glaſs, which the metal one greatly ſurpaſſed in fair trials. And theſe two ſmall reflectors have been in uſe for ſome time, at a houſe built on the *Point of Linas*, on the iſland of *Angleſea*, for our *Liverpool* Pilot's ſtation, who give a good report of it.

Experiment of the diſtance of two lights not to appear as one.

Another great benefit I thought might riſe from theſe hand reflectors if they were brought to perfection; which was, that ſingle light-houſes might be diſtinguiſhed one from another, by having different numbers of windows illuminated by them; but in trying experiments with two of them, ſet in the firſt and ſecond ſtair-caſe windows of the light-houſe already mentioned, fig. 6, they appeared, at three miles diſtance, only as one light, though they were above ten feet aſunder; and they required to be ſet in the firſt and third windows, which are above nineteen feet aſunder, to appear as two diſtinct lights, at three miles diſtance: which ſhews how much theſe imperfect hand reflectors illuminated the atmoſphere, and how neceſſary are experiments before new deſigns of this kind are put in execution.

Windows made round, and with the beſt glaſs, recommended.

In light-houſes, where reflectors are deſigned to be uſed, and the lights required to be ſeen at the greateſt diſtance poſſible, according to their high and low ſituation above the level of the ſea, the reflectors ſhould be made to ſtand with their axes, or centers, pointing to the horizon; but where they are only required to be ſeen at a ſmall diſtance to lead over a bar, or through a channel near them, then the reflectors ſhould be pointed to the moſt neceſſary or moſt dangerous place; by which means the moſt rays of light are reflected to where they are moſt wanted. And from experience we find, that plate ground glaſs anſwers much the beſt, both for reflectors, and the light-room windows: and the larger panes, and the leſs wood in the window frames to obſtruct the light, the better; and the windows that are framed round or circular, as well as the light-houſes, ſtand and reſiſt the wind much better than thoſe that are made flat by the octagon or eight ſided form. And to keep light-rooms as clear of ſmoke as poſſible, I would recommend a large opening in the centre of the conical roof, with a nice cover, and a large vane to make it traverſe freely with

with the wind; the ſpindle to be fixed to what is called the dragon, with its point through a collar into a ſocket below it: for to withhold whatever contrivance, or the beſt materials that can make them moſt perfect, as far as their fund which is to ſupport them will afford, ſhould be looked upon as an act of great villainy, for the reaſons given.

EXPERIENCE makes another remark here neceſſary; that without there is a ſmall vacuity made in the walls of light-houſes, for the wet to drain down, it will beat through, and rot the wood work.

ON IMPROVED LAMPS FOR REFLECTORS.

IT is a plain and obvious fact with reſpect to reflected light, that the ſtrength of it muſt neceſſarily be, in an exact proportion to the brightneſs and intenſity of the luminous body. Since the introduction therefore of what is called the *Patent Lamp* (which muſt be allowed greatly to exceed all others in this important point) it is very natural to expect, that the utility of our preſent lights, which have hitherto had very happy effects, may be rendered much more complete, by applying a burner upon the ſame principle as the *Patent Lamp*, before the reflector, in lieu of that made uſe of at preſent. With this view, ſeveral experiments have already been tried, with a metal reflector of eighteen inches diameter; and thoſe have ſuggeſted other experiments, which hold out ſtill more extenſive improvements. We tried the effect of ſmall lenſes with ſmall reflectors, which proved the advantage of the principle, but could not get large lenſes of ſolid glaſs made here, but got ſome blown in the form of a plano convex, like a bottle, and filled with ſtrong brine to prevent their being broke by froſt, which anſwered the purpoſe to magnify the light, but the heat of the blaze of the lamp and reflector broke them.

On Improved Glaſs Reflectors and Lamps, with Solid Glaſs Lenſes before them for Light-Houſes.

THESE improvements were brought to *Liverpool* by Mr. *Thomas Rogers*, whoſe addreſs was "Patentee for "ſtained reflectors, &c." in *London*, related the hiſtory of his proceedings to the author as follows.

THE Trinity houſe in *London*, very generouſly built a temporary light-houſe on *Black Heath*, to try experiments to improve light-houſes, and after they had done very laudably, adverti ſed liberty to any other people to try experiments for this important purpoſe.

Mr. *Rogers* being in the glaſs trade as abovementioned, got reflectors blown in one piece of glaſs to their form, and by a new method ſilvered over the convex ſide without quick-ſilver, made them very bright good reflectors, and had what I call a large circular patent lamp three inches diameter, conſequently the wick nine inches round, ſtands at the focus of the reflector, and before it a plain convex lens of ſolid glaſs twenty one inches diameter and five inches and a half thick in the focus, which makes the light anſwer the principle of the Magic lantern upon an enlarged ſcale.

THE firſt of this improvement was ordered and put in uſe at one of the Portland light-houſes, next at the Hill of Hoath near *Dublin*, the report of them ſeems incredible, and to very great advantage in hazy and foggy weather. And he is now putting them up at *Waterford* light-houſe, and brought one of them here to *Liverpool*, and had it tried in three different places to compare with reflectors made with plain pieces of looking glaſs which it ſurpaſſed.

IN the laſt converſation I had with him, his reflectors were but twelve inches diameter, he ſaid he would get them enlarged to eighteen inches, then he reckoned he would not loſe one ray of light from going through his lenſes, which I hope will have a fair trial at our light-houſes here, where we require the moſt perfect lights that can poſſibly be got made, not only to be ſeen at the greateſt poſſible diſtance without our moſt extenſive ſand banks, to let ſhips ſee that they are in a fair way, but to diverge to each ſide as much as neceſſary, to let them ſee when they are out of a fair way, which is the moſt important, for ſhips in a fair way, are in no danger in compariſon with thoſe that are out of a fair way, as may be ſeen by the charts of our Harbour.

CIRCUMSTANCES

CIRCUMSTANCES of times and places are ſo variable, that no direct rule can be laid down for this purpoſe; yet ſomething ſhould be ſaid to endeavour to prevent, as much as poſſible, running imprudent riſks at improper times; which has to my knowledge occaſioned great damage, and many total and fatal loſſes. ---When both time and tide prove favourable to a ſhip's ſituation, it is then a point of duty, and highly commendable, to puſh forward with all poſſible expedition to get into port.

BUT when either the time, or the tide proves unfavourable to a ſhip's ſituation, then it is the duty of the commander to be upon his guard, and to act with prudent caution, as the occaſion may require; and to conſider and conſult what ought to be done; and not to be perſuaded even by a pilot to run at an improper time of tide, or in the night, or when it rains, ſnows, hails, or in hazy or foggy weather, when it is well known that neither lights nor any other objects can be ſeen at a ſufficient diſtance to keep clear of dangers; and where the lead, nor compaſs courſe, cannot be depended upon for guides. At ſuch times and under ſuch circumſtances, and eſpecially when the waves run dangerouſly high upon the ſhoals, the utmoſt endeavours ſhould be uſed to keep clear of them till a favourable time and tide offer, to get into ſafety; and nothing but to ſave a ſhip from ſinking, or foundering, in deep water, ſhould be a ſufficient reaſon for running farther among dangers than there is a proſpect of ſafety, whilſt there is any poſſibility to keep off from them.

ON RUNNING FOR LIVERPOOL AT IMPROPER TIMES.

THE want of ſuch prudent precautions and endeavours, as laſt mentioned, has occaſioned great damage, and many fatal loſſes, in attempting at improper times to get into the port of *Liverpool*; where the dangers are ſo many and great, as to require not only a proper time of tide, but clear weather and day-light, to proceed with a common chance for ſafety. Yet ſuch has been the imprudence and folly of Pilots and commanders of ſhips, as to run for our dangerous crooked bar channels, when no guides could be ſeen, and no compaſs courſe nor the lead could be relied on; by which they have loſt their ſhips and lives. And ſome fatal loſſes have been occaſioned by ſubverting the very advan-

tageouſly deſigned uſe of our light-houſes, which are to ſhew ſhips the way into *Hoylake*---a good road-ſtead---to wait for a ſuitable time and tide to get through the dangerous channels into the river, or to get and keep a ſhip in a fair way, to be ready to proceed through the dangerous parts of the channels, as the circumſtances of the wind, time, and the tide flowing but a little after day-light, may require.

BUT the great abuſe and ill uſe made of theſe lights, have been, in running in by the two ſea lights, with gales of wind right upon the ſhore in the night; and, inſtead of running into *Hoylake* by the two *Hoylake* lights, as abovementioned, they have attempted to run through our dangerous Rock channel, where the veſſel has been beat all to pieces, and nothing but the floating wreck has made known the misfortune,---no people being ſaved to tell the melancholy tale---which might have been avoided by running into *Hoylake*, or keeping off, under ſail, to windward of the ſand banks, till the next day's tide; as a Pilot of one of theſe unfortunate veſſels was adviſed to do (when they boarded him) and which ſhould be the practice of all ſhips trading to the port of *Liverpool*, whilſt it is poſſible to be done. It is certainly better in a gale of wind to keep a ſhip under ſail to windward, though it may be troubleſome, than to riſk riding upon a lee ſhore to wait for a proper time and tide; and eſpecially at the S. E. buoy of *Hoyle*, where the ſhips lie openly expoſed to ſuch high waves from the ſea, as often to break the cables th.t have been long foreign voyages; but if they hold, it prevents their heaving a head againſt the flood; and to ſave tide, it is very common to cut or ſlip their cables, and run a riſk in caſting and getting the ſhip fairly under way at ſuch times in ſo little room, without anchors to bring them up, as the occaſion afterwards may require; which has often been the cauſe of great damage, and always a certain expence and riſk in getting the anchors again.

Recommended not to run till a proper tide and time offer.

ALL poſſible pains ſhould likewiſe be taken by obſerving very nicely the marks on ſhore, (as mentioned in the inſtructions of the chart) to hit the proper time of tide according to the ſhips draught of water; for when the waves run high, there may be as much danger in running too early, as too late, of the tide: for when the tide *falls faſt*, a ſhip ſoon ceaſes from ſtriking hard; but which ſhe continues to do all the time it *flows*, and may be drove out of the beſt of the channel; for if a ſhip ſtrikes till ſhe loſes her head way through the water, ſhe is then left in a manner entirely

To obſerve the height of the tide by the marks on ſhore.

Danger of running too ſoon tide.

to

to the power of the tide, wind, and waves, which may prove of fatal conſequence at ſuch times, by driving her quite out of the channel as the water flows, as we have ſandbanks detached from the main, which have very little water upon them at common tides; ſo that a ſhip ſtands but little chance of beating over them, or the people of getting to the main, to ſave their lives, if they are obliged to quit her.

To guard againſt croſs tides

IN the fineſt weather and ſmooth water, it requires great care to obſerve and manage ſo as to fall in with the ſhoal parts of theſe channels at the proper time of tide, and to have a breeze of wind to command the ſhip and keep her in a fair way and from being carried by the croſs tides, that run over the ſands, through the ſwatches, and falſe deeps, out of the proper channels, in ſpite of a boat towing a head, without a breeze. It is therefore too dangerous to attempt paſſing the channels in a calm. But where a calm or baffling winds are likely to happen when paſſing them, boats to tow, or the anchor ready to let go, ſhould be made as ready as poſſible, to prevent the ſhip being carried on ſhore by theſe croſs tides; which has often happened, and loſs and great damage been the conſequence, by the tide waſhing the ſand from under her more in one place than another, that occaſions her ſtraining and does much more damage than if the ſhip laid on firm ground.

On grounding on a ſand bank when the flood tide runs ſtrong over it.

WHAT I think farther deſerves particular notice on theſe occaſions, is this; I have ſeen many inſtances of ſhips, by running too early in the tide, having come a ground upon a ſand bank, with the flood tide running very ſtrong over it; when, they have let go the anchor to prevent the ſhip driving farther on; and, though they have veered out a long ſcope of cable, have been much deceived in their expectation to bring the ſhip round with her head upon the tide to ride her; becauſe, ſhe drawing moſt water aft, it hangs her by the ſtern on the ground, nearly end on to the tide; ſo that the anchor ſeldom holds to bring her more than broadſide to the tide; which increaſes the ſtrain, to bring the anchor home; ſo that ſhe ſwings and lies with her ſtern, nearly end on to the tide, as at firſt; and drives farther and farther on with the flood as the anchor comes home, which may prove of bad conſequence in many ſit ations. Therefore I have often thought that this might be prevented, by putting a ſpring or two upon the cable, with a rolling hitch, &c. to have two parts, one on each quarter, ſo as to ride the ſhip by the ſtern, till the tide

A hint to ride a ſhip by the ſtern.

flows ſufficient to give room to ſwing clear of the ground; and, as the ſituation may require to ſheer or caſt her ſtern towards the deepeſt water, by ſlacking or letting the ſpring go on the ſide deſigned to caſt her, to lay the ſtrain on the ſpring, and the helm on the other quarter, taking care that the cable is clear of the heel; by which means a ſhip may be ſwung, or ride by the ſtern, clear of the ground, till their is water to ſwing her, or till the tide is done, as the occaſion may require.

On fogs.

I HAVE known ſhips get a ground, and receive great damage, by being catched in the narrow and ſhoal parts of channels in a fog; and as fogs are only low clouds, or moiſt denſe vapours near the ſurface of the earth, I have heard of inſtances, where, by going to the maſt head, they have got ſight of objects for their guide, when nothing was to be ſeen from the decks; and I recommend this expedient, as worth a trial, when there is occaſion for it.

HAVING ſaid ſo much on the *Conſtruction* and *Management* of *Veſſels*, in general; I think it may be of ſome uſe if I add a few obſervations on the conducting of them in time of *War*, ſo as beſt to provide for their ſecurity, and the annoyance of the *Enemy*.

ON LETTER OF MARQUE SHIPS AND PRIVATEERS.

THIS is a buſineſs that has, and, moſt likely, always will be purſued in this kingdom, in time of war with other trading nations. Ships, as well as armies, are well known to be more or leſs powerful, according to their force, in proportion as the people are diſciplined and exerciſed in their duty. I have known our people vaſtly at a loſs, both in privateers and merchants ſhips when a war has happened after a long peace. In the firſt part of the war of 1739, I was in an *Eaſt India* ſhip of 32 guns; and a letter of marque ſhip in the *Jamaica* trade; where our great guns and ſmall arms were never exerciſed, becauſe none on board either ſhip, knew how it was to be done; which might have been the occaſion of the loſs of ourſelves and ſhips, if we had happened to have fallen in and engaged with diſciplined ſhips of equal force, which, it muſt be allowed, have greatly the advantage over ſhips whoſe crews are not diſciplined; for even the more daring and brave they are, the ſooner they are liable to fall into confuſion; and

and which our people are moſt liable to, from being in general too eager to fight, and regardleſs of dangers from ſuperior diſcipline or force, or any other diſadvantages that may attend their ſituation. This proves the neceſſity that ſome inſtructions ſhould be attempted for our letter of marque ſhips and privateers, to prevent, as much as poſſible, their ſuffering from their own extraordinary courage and bravery alone. Therefore, from the experience of two wars, I ſhall endeavour to point out what I think may be of ſome ſervice in the beginning of a war, to fit them the better to attack an enemy; or, being attacked, to defend themſelves in the courſe of a voyage, or on a cruiſe againſt the enemy.

BUT I muſt own this is a taſk much more fit for thoſe gentlemen who have had the experience of the late brave actions and improved diſcipline of our incomparable Royal Navy. And as I never had that advantage, I hope my defects will be thought the more excuſable.

On Fitting out Letter of Marque Ships and Privateers.

SAFETY, as well as ſucceſs, in my opinion, depends greatly on the manner theſe ſhips are fitted out. Trading ſhips deſigned more for defence than offence, I would recommend to be made to look as big, powerful, and warlike as poſſible, in order to intimidate; but privateers the contrary, to look as little and defenceleſs, and conceal their power, as much as poſſible, till there is a real occaſion for it; and then as ſuddenly as poſſible to make it known, to give the greater ſurpriſe; which I can ſay from experience may often give great advantages.

As to the ſize and number of great guns; the dimenſions, ſtrength, and properties of the ſhip, (as mentioned from page 30 to 37) ſhould point out what ſhe will be able to bear without being too crank for a ſailing and a fighting ſhip; and though it muſt be allowed that the advantages in a ſea fight are greatly in favour of the heavieſt ſhot; yet the many ſtorms a ſhip may have to contend with, in a winter's paſſage, or a cruiſe in a turbulent ocean where the great guns may be often rendered an uſeleſs and dangerous incumbrance, by the waves running ſo high, that nothing but ſmall arms can be uſed againſt the enemy, ſo a ſhip

ſhould

ſhould not be over-crowded, or over-burdened with too heavy cannon.

ON IMPROVING GREAT GUNS AND CARRIAGES.

IN order to remedy thoſe great diſadvantages which I have experienced in the difficulty and great delay of getting our common guns mounted on common carriages, and pointed to my mind on the objects aimed at, not only in merchant's ſhips, but on batteries on ſhore with the King's guns and carriages at *Liverpool*, where I had the command, (as repreſented plate 11. fig. 6.) I recommended to have our great guns caſt with an oval knob on the top of the muzzle, with a ſcore filed on it, and another on the breech, exactly parallel with the bore of the gun, ſo as to make one direct ſight to the object aimed at (as repreſented fig. 7, plate 11.) and mounted on, what I call, a ſwivel carriage; which is not only a great advantage to a ſhip in carrying her great guns with more eaſe and ſafety than the common carriage, but to the men in exerciſing and fighting them; which I ſhall endeavour to prove from reaſon and experience.

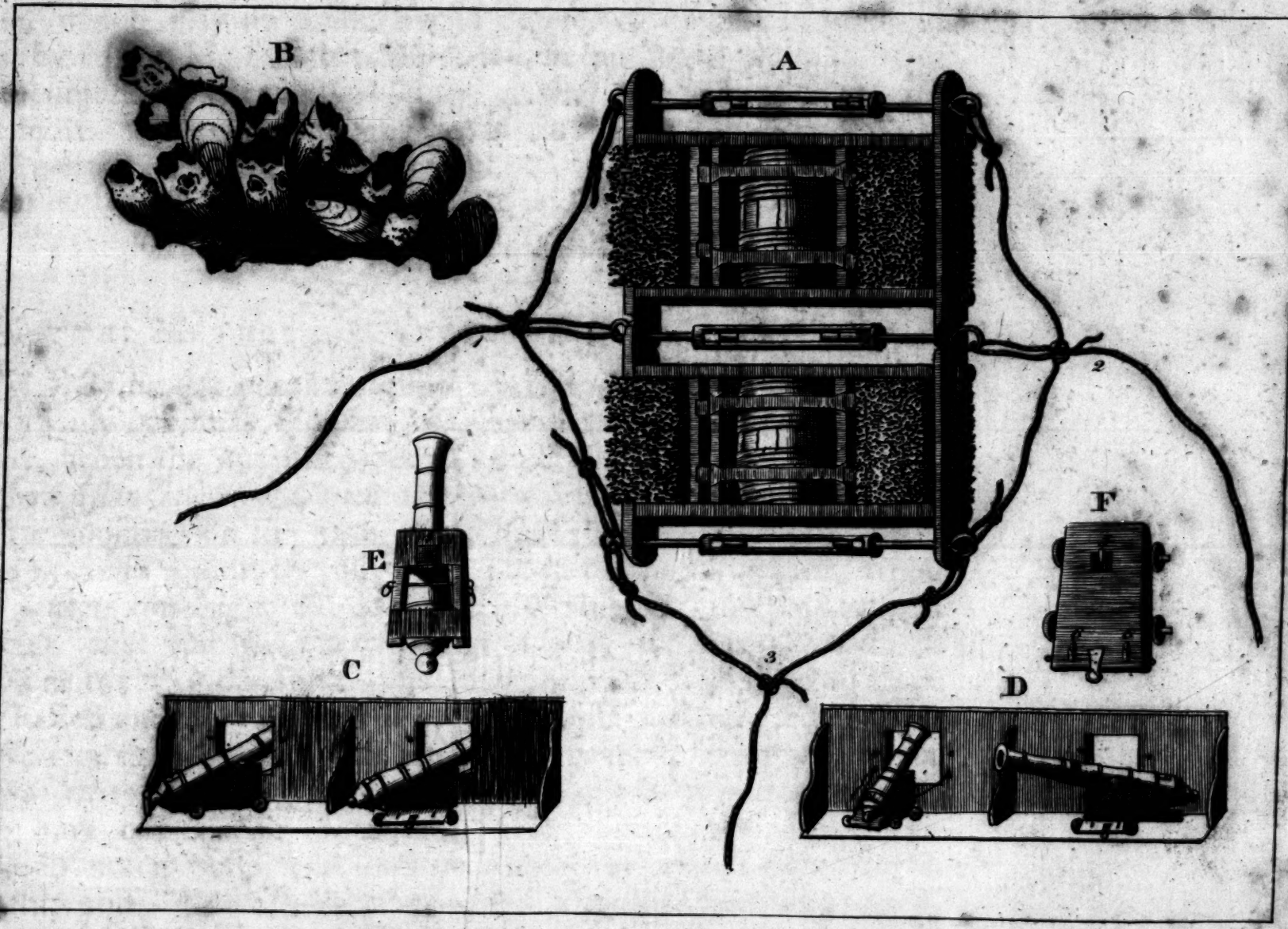
Short and light guns caſt with an oval knob on their muzzles recommended.

OUR late improvement, in the metal, caſting, and boring of iron cannon, makes me recommend that they may be made ſhort, and as light of metal as poſſible to bear a ſufficient proof; which not only gives proportional ſafety and eaſe to a ſhip, in the times abovementioned, but they are managed and fought with greater ſafety, eaſe, and expedition, and will do ſufficient execution at the ſhort diſtance the bravery of our people makes it neceſſary to fight our ſhips to the greateſt advantage.

ON THE COMMON GUN CARRIAGE.

GREAT guns, mounted on theſe carriages to be ready at ſea in time of war, are commonly carried either run out of the ports, or kept houſed, with their muzzles againſt the ſhip's ſide at the upper parts of the ports, as repreſented by one in letter D, plate 9, but which is delineated in a much more maſterly manner in

PLATE 9th.



in *Falconer*'s Marine Dictionary (which came out a good while after my plates where ſtruck off.) In this 7th plate, the guns are repreſented, both run out, and ſtowed as laſt mentioned, fig. 19, with the muzzle againſt the ſide of the ſhip above the port; and he very judiciouſly remarks, in the ſecuring the guns, to hook the tackles ſo that a ſecond breeching may be added, laſhed and bowſed as tight as poſſible, to prevent the guns from breaking looſe, which may be productive of dangerous conſequences: and this by report has ſo often happened in our Royal Navy, that it was conjectured, that the Victory, a firſt rate ſhip of war, was loſt by it. Therefore this method of carrying great guns deſerves more particular notice.

ON THE METHOD OF CARRYING LOWER DECK GUNS.

I MEAN on this occaſion to ſpeak principally from the experience of only one ſhip, that had only been three voyages to the *Eaſt Indies*, when ſhe was fitted out firſt to cruiſe three months off the *Weſtern Iſlands*. We carried thirty-two guns, and eight of them twelve pounders on the lower deck, houſed as laſt mentioned, with their muzzles againſt the ſhip's ſide above the ports, which, when the waves run high, did ſo work the ſhip, to ſuch dangerous degrees, that for the ſafety of the whole, we were obliged at different times to put theſe guns down into the hold, and to leave our ſtation and run for ſafety to a port, to get our leaks ſtopped.

NOTWITHSTANDING this method is general, in all large ſhips of war that carry lower deck guns; yet I appeal to reaſon, and all who have obſerved or conſidered, what occaſions theſe guns to make ſo much noiſe, and fetch ſo much way in and out; for as the ſhip rolls, works, and labours at ſea, as has been mentioned, ſo muſt theſe guns be an additional power according to their weight and number added to the weight above them, of maſts, yards, rigging and ſails, all which combine with high waves to ſtrain and make the ſhips ſides bend, and fetch the more way, as ſhe rolls, and eſpecially in that part made weak by the tier of lower deck ports, a little above the water's edge, where theſe guns are ſecured in the manner abovementioned by their breechings at the lower part of the ports, and their muzzles to the ſide above the ports, which part muſt naturally bend and give more way when the

The cauſe of lower deck guns breaking looſe.

the ſhip rolls, than the lower part of the ports, where the breechings are made faſt (as may be ſeen by the figures abovementioned): by which it muſt appear evident to reaſon, that of this tier of guns, in every violent low roll the ſhip makes, thoſe on the lower lee ſide (as it may be called) muſt move altogether, and preſs their muzzles with great power againſt this lee ſide ſo as to ſtrain it outwards, and to ſlack the takles and breechings greatly, when at the ſame time the weather, or upper ſide, bends in proportion againſt the muzzles of the weather guns, to force them inwards farther than the ſtretching and ſtraining of the breechings can, with ſafety, be expected to allow; ſo that I rather wonder that they do not break looſe oftener, eſpecially in old, weak, labourſome ſhips, and that, more frequently in three deck ſhips than in two deckers, becauſe they have ſo much more weight and two tier of guns above them, to ſtrain and work the ſhip the more, in proportion, at the lower deck ports, as abovementioned.

ON CARRYING THE GUNS RUN OUT.

BY this method it muſt be allowed, that they are carried with more eaſe and ſafety from the damage and danger abovementioned, ſecured only with their two takles, that confines the breaſt of the carriage cloſe to the ſide at the ſill of the port, where the ſtraining of the ſhip can have little effect between that and the deck, ſo as to make the guns fetch any way worth notice. But their projecting ſo far without board, expoſes them at all times, and to all weathers; and each gun muſt have, what is called, a half port; which are both troubleſome and comberſome; and the gun ports muſt be kept hauled up, which makes what may be called a rough and incumbered outſide, and which in ſmall and deep loaded ſhips, when carrying a ſtiff ſail upon a wind, are plunged into the ſea, and ſtops water to leeward, whilſt thoſe to windward hold wind; which muſt naturally be a great hinderance to a ſhip ſailing upon a wind, and be liable to wet the charge in the guns. Therefore to remedy theſe defects, and other inconveniences that attend the great guns being mounted on the common carriage, is the reaſon why I take the liberty to ſpeak in commendation of a fair trial to be made of ſwivel carriages for great guns.

THIS

THIS carriage muſt be allowed to be ſome what more complex than the common one, becauſe it conſiſts of two parts: the carriage part, with the iron work for the gun, takles, and breechings, as in common with other carriages; and the ſole of the carriage, on which it ſwivels or turns, as occaſion requires, as repreſented by the figures E and F, plate 9. We had a ſet of them made for the *Liverpool* Privateer's guns, that carried twelve pound ſhot. The ſole parts, as repreſented by the figure F, were made about three inches thick, with iron axes, and lignum vitæ ſix inch trucks; ſo that the gun ſhould be juſt ſwivelled about over them on the ſhort bolt, figure 5, that was drove upwards with a ſquare head below, that had holes in the corners for four nails, and a ſquare plate above, a little rounding upwards, with holes at the corners, fitting the bolt, and let in, even with the ſole; at the inner part of which is fixed a dove-tail plate, with an eye for the train takle, and two iron palls that turn in grooves, in and out, with the direction of the ſole on the ends of the eye bolts, exactly to confine the gun and carriage in a ſtraight direction with the ſole, as ſhewn by the figure 6, in the train part of the ſole.

THE carriage part E, was made, as in common without the carriages, to fit the ſize of the gun, and, when upon the ſole, the height of the port; and, to unite it to the ſole part, a three inch plank was fixed right under the trunnions of the gun, with the four bolts of the trunnion irons clinched through it, even with the wood, and likewiſe faſtened to the croſs breaſt-piece of the carriage, with a hole and two ſquare plates, one above and another below in the middle, as repreſented figure 4, at E, juſt to fit and turn eaſily round the centre bolt in the ſole figure 5, where a double forelock goes through the upper end to ſecure together the ſole and carriage part. At the inner or train part, is fixed an inch plank, faſtened with the eye-bolts, for the gun takles, clinched through it, for the bed and quoin of the gun to reſt upon; and all this lower part of the carriage, as well as the upper part of the ſole, was made as plain and ſmooth as poſſible; and the ſtreſs or friction lay chiefly on the two iron plates under the body of the piece; ſo that when the two palls were turned back, the guns could be eaſily ſwivelled round by hand, any way the occaſion required.

THE circumſtance of theſe ſwivel carriages carrying the guns with more convenience, eaſe, and ſafety to the ſhip than the common carriage, muſt be allowed to deſerve ſome notice and attention; for on a winter's cruiſe or paſſage in a turbulent ocean, there

may be more danger from the violence of the waves to be contended with, than from the enemies ſhips; and the guns mounted on theſe carriages, after exerciſe or action, at the word of command to houſe and ſecure the guns, are ſwivelled round upon the ſoles fore and aft, with their muzzles forward; then the takles are hooked to the two eye-bolts at the train of the ſole, which is bowſed with the gun cloſe to the ſide, and there ſecured by hooking the takles to the eye and ring-bolts, of the carriage part, and to thoſe in the ſide where the takle-falls are expended in laſhings round and about the guns; by which they may be ſecured and ſtowed ſnug, and the moſt out of the way that is poſſible, either on the upper or lower deck, cloſe to the ſhip's ſide, without preſſing hard againſt it; all their weight, within board, reſting on the ends of the beams and the lodging and hanging knees, where the decks and the ſhip's ſides are ſtrongeſt to ſupport and carry them, not only with more eaſe and ſafety, but it affords more room within board to work and manage the ſhip, than when they are carried run out, and gives the advantage of keeping all the ports cloſe ſhut to keep the guns dry in ſmall or deep loaded ſhips, and conceals them till it is neceſſary to ſhew them, and avoids all the other diſadvantages that have been mentioned to attend their being carried conſtantly run out. Theſe reaſons, and other advantages that I have experienced to attend the ſwivel carriages, I hope will be thought ſufficient to recommend them for the purpoſe of carrying the guns with more eaſe and ſafety to the ſhip, than the common carriage, either on the upper or lower deck; where the difference is repreſented by the two guns in figure D, plate 9. And in order to bring into practice what I call the improved gun and carriage, I got a ſmall cannon caſt with an oval knob on the top of the muzzle, as mentioned page 191, with a ſmall hole in the caſcabel, and a ſmall iron crow, fitted to it, and mounted on a ſwivel carriage, as repreſented figure 7, plate 11.

On the Diſadvantages of the Common Guns and Carriages.

A COMPARATIVE difference can only be known by fair trials in practice, either in exerciſe or action, when orders cannot be heard, and muſt be gived by ſigns made by hand to get the common carriage and gun pointed to the object aimed at, as repreſented

repreſented fig. 6, plate 11; where the captain of the gun is firſt obliged to ſtoop low, to look along the ſide ſights, and then to make motions with his hands to his help mates, who with their hand-ſpikes, raiſe or fall the metal to the level of the object. He then looks along the top ſights, and taps with his hand on the ſide of the carriage for the men to breech the gun fore and aft, till he can get it in a ſtraight direction to the object; which is often long and tedious; for the men are liable to breech the gun two far, or not far enough, which tires his patience, eſpecially when he hears other guns fired long before his, and makes him make the ſignal to fire, though wide of the enemy, rather than be thought ſo much behind the others, who may, to ſhew themſelves briſk, be induced to fire at random, if not ſtrictly attended to by their officers, who cannot attend every gun; by which our ammunition is expended to no purpoſe. And when the ſituation of the enemy requires the gun to be pointed as much forward or aft as the port will allow; (as repreſented figure C, plate 9) it may be perceived how the common gun and carriage will recoil a great way from the port, and eſpecially if the lee guns and the ſhip's heel occaſion time and trouble to get it oppoſite to the port again, where the men are expoſed to the enemies ſmall ſhot all the time of charging the gun again, as may be perceived by the common gun and carriage as repreſented fig. D, plate 9. And neither the ſide nor top ſights of theſe guns point direct to the object aimed at; for from the muzzle being ſo much ſmaller than the breech, the ſide ſights point *wide* of the object, and the top ones *below* it, even at a point blank diſtance; which increaſes the perplexity and the difficulty to hit it.

On the Advantages of the Improved Gun and Carriage, above the Common ones.

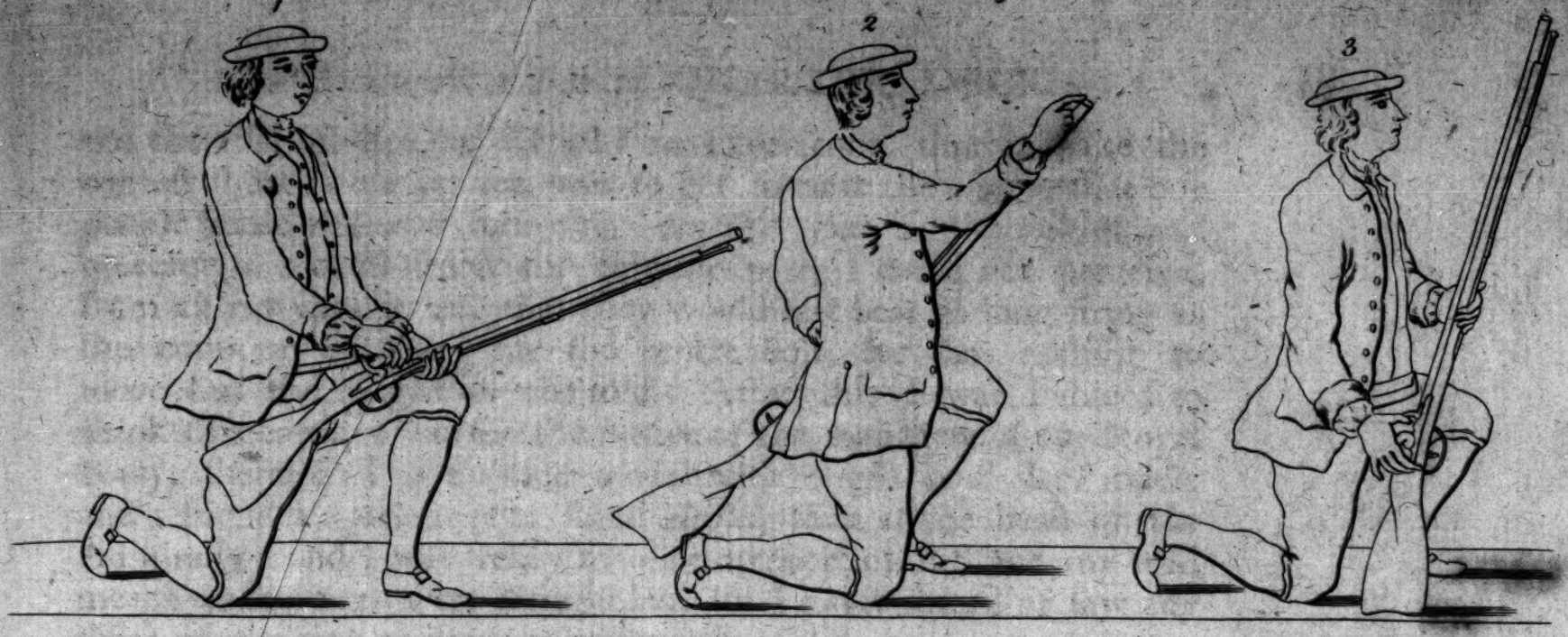
TO make a fair compariſon of the great advantages of theſe guns and carriages above the common ones, as laſt mentioned.---In the *Liverpool* Privateer, our ſpare carriages were of the common ſort; and at a favourable opportunity, when going to exerciſe our great guns, I ordered, and had one of them mounted on a common carriage nearly a-midſhips; and to make a fair trial of the difference, had it exerciſed with the ſame number of men

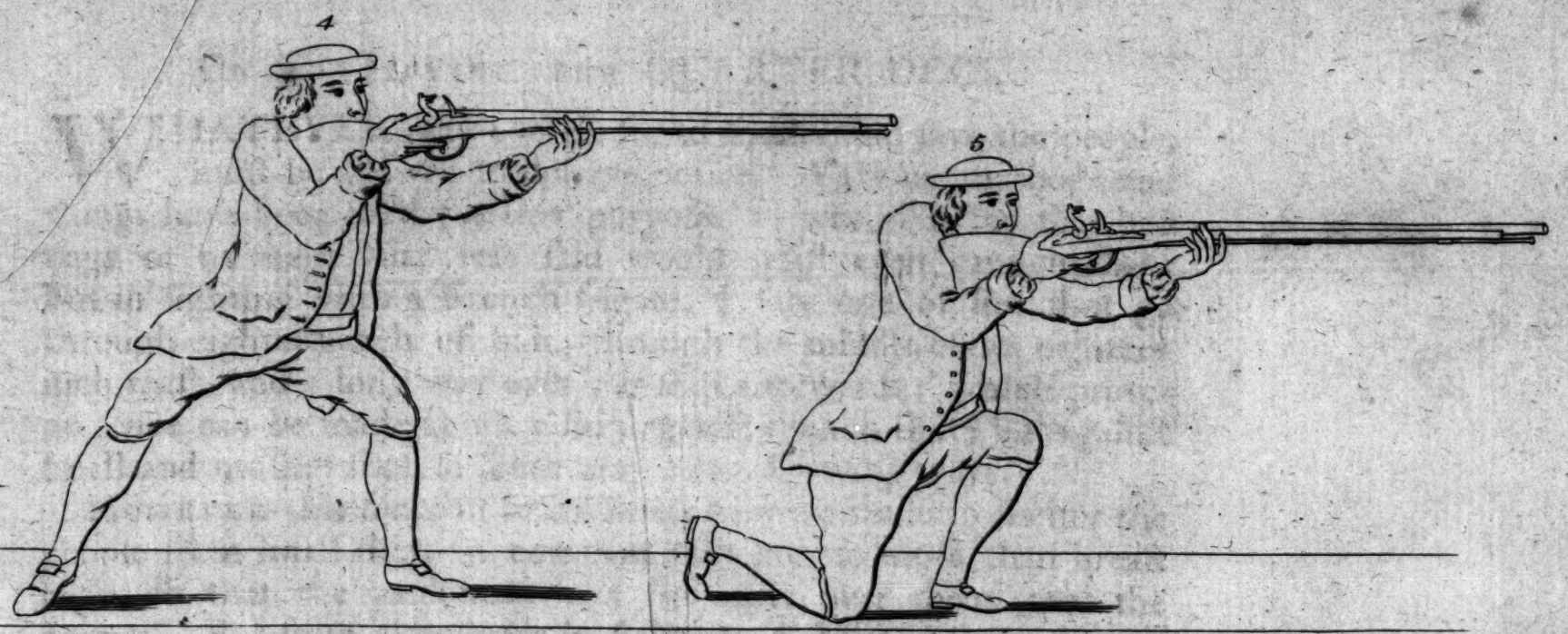
as we uſed to do with the other guns, and gave the word of command proportionally ſlower than uſual, and as this gun required, till the people had got expert in working it; then had an empty caſk put out for this and the ſwivel gun to be pointed at, and ordered them to go through all the motions of charging and firing as faſt as they could, pointed at the caſk; and the difference of time, obſerved by my officers and myſelf, between the gun on the ſwivel carriage, and that on the common carriage, in diſcharging, was five times of the ſwivel gun for three of that of the common carriage; and the men at the common carriage were ſo greatly tired with their hard labour, in proportion to thoſe at the ſwivel carriage next them, that they begged to have their gun mounted on the ſwivel carriage, which was done.

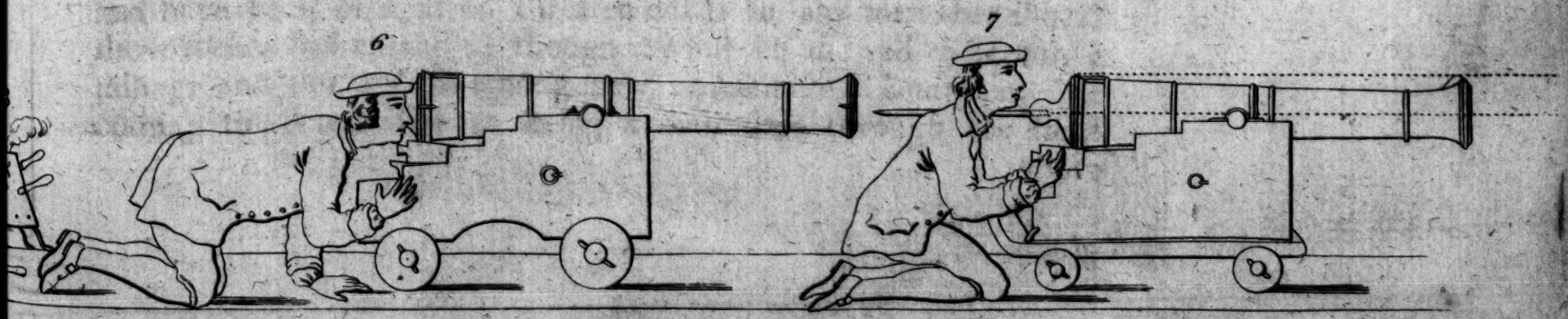
IN action they have likewiſe greatly the advantage, not only of being fired ſo much oftener, but with more eaſe and certainty to do execution; for when the gun is run out, the captain of the gun himſelf can put the crow in the caſcable, and put his ſhoulder under it; and by looking along the top ſight, that is parallel to the bore, and by twiſting his body, can ſwivel the carriage and point the gun direct to the object; and, with his hands at liberty, can fix the bed and quoin to keep it there (as repreſented figure 7, plate 11.) then holding up is right hand for his help mates to give the match or fire iron, he gets up and pulls out the crow with his left hand, and fires the gun himſelf at the moſt favourable inſtant to do execution; as may be perceived by comparing it to figure 6, and what has been ſaid on this occaſion. And when the ſituation of the enemy requires the guns to be pointed as much forward or aft as the ports will allow (as repreſented plate 9, figure C) it may be perceived that the ſole of the ſwivel carriage ſtands in a direction right in and out; ſo that when the guns are fired, they recoil right back oppoſite to the part, and the gun is ſwivelled with its muzzle forward, where it may be charged again by the people, ſheltered from any ſmall ſhot that may be fired in at the port, and which the common carriages are expoſed to, as repreſented figure D, plate 9.

BUT it muſt be acknowledged, that theſe ſwivel carriages require a little extraordinary trouble to keep the upper part of the ſoles clean, and greaſed a little at times, to make the guns ſwivel eaſily upon them. As it is common to hear objections againſt new things, the only one I have heard againſt theſe, is, that they would not ſtand a long and conteſted fight; which I own we had not

PLATE 11th.







not the trial of, having learned from experience, that to make the conteſt ſhort in our favour, was to get ſo near the enemy that our people could not well miſs their object. But as the takles and breechings are all upon the carriage part, I could not perceive, from all my experience, that they would not bear as long firing as the common carriage; for the centre bolt, &c. has nothing to move but the weight of the ſole. After this I was induced to think this carriage worthy the notice of the managers of our Royal Navy, therefore I got a nice model with a gilt gun, &c. made, and a friend to preſent it to Lord *Anſon*, then at the head of the Admiralty; and I was ready to give a report of it: but my well meant endeavours were diſregarded, for I never heard or ſaw any thing of my gun or carriage afterwards.

ON FORTIFYING THE QUARTER-DECK.

WHATEVER may contribute to ſhelter and ſave the people, muſt be allowed to deſerve notice. Various methods and things have been tried for this purpoſe. I was in a ſhip that had bags of ox hair, that was ſaid would reſiſt even cannon ſhot: but in fighting with a French frigate, I ſaw one of her ſhot go through eighteen inch of hair, through the middle of an eighteen inch maſt, and a long way over our ſhip afterwards; which proves no fence can be made about a ſhip againſt cannon ſhot; but againſt ſmall and muſket ſhot, a fence may be made many ways.

HOWEVER this fence or breaſt work may be made to ſhelter the people from ſmall ſhot, in common they are no more than breaſt high, ſo that the muſketeers can fire fairly over them upon the enemy. But from experience in fighting, I have obſerved among new fighting men, there will always be ſomething to ſhew that natural inſtinct of ſelf preſervation; and in order to keep their heads under ſhelter of the breaſt work from the enemies ſhot, they fire their muſkets at random up into the air. Seeing this, and to prevent the bad effect of ſuch examples in fighting, I have made a feigned lunge at a man's breaſt with my drawn ſword, and have been obliged to threaten death to any man that ſhould ſhow ſuch a bad example; though it muſt be allowed to be only a failing, and not a fault among new undiſciplined landſmen, firſt coming to action, who at ſeeing a man ſhot through the head

above

above the breaſt work, may ſhow a little fear, but by practice may prove brave afterwards.

THEREFORE to remedy this defect which I perceived in fighting the ſmall arms; in fitting out a privateer afterwards, we had a rail, as in common, breaſt high on each ſide the quarter deck; and on the rails were fixed light iron crutches, with the arms about a foot ſquare, and a ſhoulder to keep the bottom of the crutches about ſix inches above the rails, and thin boards about ſix inches broad, laid upon the bottom of the crutches; and netting, with large ſquare meſhes, were formed juſt to hold a hammock with its bedding longways; and from the gunnel to the rail was boarded up on each ſide of the ſtanchions, and filled up with rope ſhakings, cork ſhavings, &c. which are found ſufficient proof againſt muſket ball; which made ſo ready and good a fence for the quarter deck muſketeers, that the moſt timorous could point his piece with the utmoſt confidence between the rail and the netting, and fire right upon the enemy, by having his head, as well as his body, under ſuch ſecure ſhelter.

For the ſame reaſons in clearing and preparing the ſhip for fighting, I uſed to make the forecaſtle and top men, laſh the hammocks, to ſhelter them, horizontally on the outſide of the fore and top-maſt ſhrouds, cloſe to one another, breaſt-high, and then a ſingle hammock above, leaving a little vacancy to point and fire their muſkets through; which guards that tender and moſt important ſeat of knowledge, the head, as well as the other parts of the body which it governs, from the enemies ſmall ſhot.

ON CARRYING SWIVEL GUNS IN THE TOPS.

THE high ſituation of theſe guns promiſes a great advantage to do great execution in cloſe fighting; but I have learned from experience, that there is not room in a ſmall ſhip's top to fight theſe guns without great danger of fire, and blowing up the ammunition cheſt, which we had once the misfortune to do, and which killed one of our top-men: For which reaſons, and the great weight and incumbrance of them and their ammunition at ſo great a height, makes me recommend muſkets only to be carried in the tops of ſmall ſhips, as they can be pointed and fired in all directions as occaſion may require, and are ſo eaſily and readily charged,

charged, that they are to be prefered to all combined pieces, called organs, &c. which are alſo under the diſadvantage of taking up more time in proportion to the muſket, in charging them after firing.

ON THE POWDER AND SHOT.

AS the execution of the ſhot to conquer an enemy depends entirely on the goodneſs and ſtrength of the powder, which differs ſo much, that the greateſt care and caution is abſolutely neceſſary to guard againſt being cheated in the quality of the powder. I have experienced ſome that looked very fine and good, made for the uſe, or rather ſhameful abuſe, of the *African* trade, that inſtead of firing ſhot with ſufficient velocity, it would hardly fire itſelf, but ſpend itſelf in phizzing one phiz after another out at the touch hole, and took up ſo much time in burning, that it could not be uſed as priming for great guns.

THIS baſe practice of making ſo very weak powder, ſhould by ſome means be put a ſtop to; becauſe it not only hurts the merchant adventurer, but the intention of government in giving ſo large a bounty on exportation for the encouragement of the trade of making good gun-powder. Therefore it ſhould be either under the inſpection of proper aſſay maſters, or examined by proper methods to try its ſtrength; for I can ſay from experience, that, the common ſmall piſtol powder provers, that drive a circular graduated plate round, do not anſwer the purpoſe, for they will differ greatly with the ſame powder.

THEREFORE I would recommend for this purpoſe of trying powder, to have a gun of a half pound ſhot, fixed in a convenient place, mounted firm on a good block or bed, elevated exactly at fortyfive degrees; and the powder to be tried, by an ounce charge, how far it will throw the half pound ſhot without any wad; and ſo in proportion for every foot or yard's diſtance under or over a ſtandard diſtance, that might be fixed by government powder, to aſcertain its ſtrength and value under or over proof, according to the different trade or purpoſe it is deſigned for, as well as for privateers or letter of marque ſhips, which ſhould be of equal goodneſs with that for the Royal Navy. Then, I reckon a quarter of the weight of the ſhot, would be ſufficient charge of powder for great

To prove the powder.

great guns; and which we had confirmed by fair trials of many actual experiments for the purpoſe, with a twelve pounder and a three pound charge of powder; for when we added to it, it encreaſed the recoil of the gun and the reſiſtance of the air to the ſhot in proportion, ſo that it made but little difference in the extent of the range.

On cannon and muſket balls, &c.

OF ſhot; the firſt and principal, both for quantity and quality, is the round iron cannon ball, becauſe it will go and penetrate farther, and with a greater velocity, than any other, to do execution, when engaging with a ſuperior force; but when come to a cloſe fight with a ſhip of inferior force, expecting to make her a prize, then the endeavours ſhould be not to deſtroy the ſhip, if it can poſſibly be avoided, but to diſtreſs them to make ſubmiſſion; therefore ſome ſuitable ſhot, that will anſwer that purpoſe beſt, ſhould be provided. And I would recomend round tin caſes (to fit the bore of the guns) filled with muſket ball; and ſquare bar iron, cut about fourteen inches long, tied in bundles with rope-yarns juſt to fit the guns; or caſt iron bars about the ſame length, a ſquare one about an inch diameter in the middle, and four others quartering, rounded on the outſide to fit the bore of the guns, when tied with rope-yarns.

ON PRIMING GREAT GUNS WITH GUN POWDER.

THIS method is not only very long and tedious in practice, but very uncertain to get the guns fired in good time, ſo as to hit the object aimed at; and is very dangerous from the ſcattered powder on the decks, which makes a train and takes fire from the ſparks of the gun match falling on the decks, that has often been, and always is liable to occaſion thoſe dreadful exploſions that deſtroy both men and ſhips, by which I have had my crew greatly hurt. And other great diſadvantages attend it; for if the guns are not fired directly after being primed, it ſoon grows hard in the touch-hole, and renders the gun uſeleſs till it can be cleared. Theſe important reaſons induced me to endeavour to bring into practice the method of priming our great guns with *Quick Match*.

THIS

THIS *Quick-Match* is made of white worſted yarn, in length three or four feet, and two or three threads thick, ſo as it may be eaſily thruſt double through the touch-holes, about an inch into the cartridge, by flat prickers, made forked at the lower end for that purpoſe. Theſe lengths of worſted are ſoaked in a mixture of freſh water and gun-powder, of the conſiſtence of treacle; then they are rolled in dry mealed gun-powder, that is bruiſed fine by the ſide of a glaſs bottle upon a ſmooth board, and drawn through the left hand till there is a coat of gun-powder paſte round them; which completes the Quick-Match. When thoroughly dried and cut in exact lengths, twice the length of the wire prickers, and ſtowed in copper or tin caſes with their brights up, they may readily be put upon the forked ends of the prickers; then with the ends between the fingers, when the cartridge is felt to be home, thruſt the bights directly about an inch into the cartridge, draw the prickers, and leave the two ends above the touch-hole, either to fire, or draw out again as occaſion may require.

IT was made in *Liverpool* laſt war for ſale, by Mr. *Henry Roſs*, an ingenious experienced old commander of ſhips, calling it "LIVERPOOL PRIMING;" he has wrote upon its great advantages, not only for ſafety to avoid the great damage and loſs of men and ſhips, lately occaſioned by priming and firing with powder and gun match as abovementioned, but the great difference it makes in quick firing the guns to hit the object; on which alone depends ſucceſs in action when ſhips are conſtantly altering their poſitions, with the great difference of time that may be obſerved between the flaſh of priming and the diſcharge of the gun, ſo that I have known a gun pointed to hit one ſhip, and the ſhot has hit another, a friend's ſhip lying wide of her.

We have made public trials with this *Quick-Match*, and fired a twelve pounder with it above four times for one primed with powder: Thus a ſhip's force may be above trebled by firing above four guns for one, and to a much greater certainty of hitting the enemy. It was fired with the common gun match, with the flame of a lamp I got made for the purpoſe of trial, and with the lock of a ſmall pocket piſtol.

IT is well known from experience, that gun match is not only very dangerous from ſparks falling on the decks, when blowing it, and ſtriking it on the priming as abovementioned, but very defective, after all, to get the guns fitted in good time, for a chance to hit the deſigned object in action. Therefore I would recommend hot irons, which, it is well known, from experience will fire great guns, primed either with powder or quick-match, much ſafer, and ſurer to hit their mark, than with the gun match; and which induced me to get firing irons, an inch and a half thick at the heating ends; with ſockets about the ſame thickneſs for wood handles; which made their whole length about twenty inches; and a ſmall fire ſtove made of thin iron plate, round like a large can, ten inches deep, and ten broad at the bottom, cut full of half inch round holes, and eight of them round the ſide, an inch above the bottom, four inches open at the top with a lid to it, and four holes in the ſides for the irons; and a wood handle that goes into a ſocket at the ſide, and ſtands upon three ſpreading feet ſix inches long, as repreſented figure 8, plate 11, that it may ſtand in match tubs with three inches water in them as in common, that will preſerve them from all accidental harm; ſo that the guns that are too far from the cook's fire place, may have their firing irons heated readily, and kept hot with ſafety in theſe ſtoves, which I have tried, and have heated the irons both with pit coal and charcoal in about eight minutes time; and with about four pounds of charcoal, which is cleareſt of ſmoke, I kept four irons hot for about three hours.

THE wood handles require a piece of leather within the ſockets, to prevent the wood burning.

THE readieſt aad beſt method to do this, is firſt to ſtation them according to their rank and capacities, by what is called a Quarter Bill; and to exerciſe them in their reſpective ſtations, as now recommended.

BUT merchant ſhips are ſo variouſly fitted out with guns and men, that it is impoſible to form a Quarter Bill to ſuit all; therefore I ſhall endeavour to form two Quarter Bills, one for a trading ſhip of fourteen ſix pounders and fifty men; and the other for a privateer of twenty nine pounders and 160 men, with common carriages; which may be varied, as circumſtances and the difference of guns, carriages, and men may require.

A Quarter Bill for a Trading Ship of Fourteen Six Pounders, and Fifty Men.

The Captain to command in chief, on the quarter deck, if it be fortified to afford common ſhelter from ſmall-arms.	1
The Chief Mate to command the ſix foremoſt guns, and work the ſhip, forward.	1
The Second Mate to command the eight aftermoſt guns.	1
The Boatſwain to paſs the word and get the Captain's orders executed fore and aft, as occaſion may require.	1
The Carpenter to attend the pumps, ſhot plugs, &c. -	1
The Gunner to deliver the powder to the boys, as carriers.	1
The Doctor in the loweſt, ſafeſt and moſt convenient place the ſhip affords.	1
A good Helmſman. - - - - -	1
Four men to each gun and its oppoſite, and a boy to fetch powder.	35
Seven men at ſmall-arms and occaſional duty. - -	7
	50

A Quarter Bill for a Privateer of Twenty Guns, Nine Pounders; and Four Three Pounders on the Quarter-Deck and Forecaſtle.

On the QUARTER DECK.

The Captain to command the whole. - - -	1
The Maſter to aſſiſt, and work the ſhip according to orders.	1
A Midſhipman to paſs the word of command fore and aft.	1

IT is well known from experience, that gun match is not only very dangerous from ſparks falling on the decks, when blowing it, and ſtriking it on the priming as abovementioned, but very defective, after all, to get the guns fitted in good time, for a chance to hit the deſigned object in action. Therefore I would recommend hot irons, which, it is well known, from experience will fire great guns, primed either with powder or quick-match, much ſafer, and ſurer to hit their mark, than with the gun match; and which induced me to get firing irons, an inch and a half thick at the heating ends; with ſockets about the ſame thickneſs for wood handles; which made their whole length about twenty inches; and a ſmall fire ſtove made of thin iron plate, round like a large can, ten inches deep, and ten broad at the bottom, cut full of half inch round holes, and eight of them round the ſide, an inch above the bottom, four inches open at the top with a lid to it, and four holes in the ſides for the irons; and a wood handle that goes into a ſocket at the ſide, and ſtands upon three ſpreading feet ſix inches long, as repreſented figure 8, plate 11, that it may ſtand in match tubs with three inches water in them as in common, that will preſerve them from all accidental harm; ſo that the guns that are too far from the cook's fire place, may have their firing irons heated readily, and kept hot with ſafety in theſe ſtoves, which I have tried, and have heated the irons both with pit coal and charcoal in about eight minutes time; and with about four pounds of charcoal, which is cleareſt of ſmoke, I kept four irons hot for about three hours.

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The Captain to command in chief, on the quarter deck, if it be fortified to afford common ſhelter from ſmall-arms.	1
The Chief Mate to command the ſix foremoſt guns, and work the ſhip, forward.	1
The Second Mate to command the eight aftermoſt guns.	1
The Boatſwain to paſs the word and get the Captain's orders executed fore and aft, as occaſion may require.	1
The Carpenter to attend the pumps, ſhot plugs, &c. -	1
The Gunner to deliver the powder to the boys, as carriers.	1
The Doctor in the loweſt, ſafeſt and moſt convenient place the ſhip affords.	1
A good Helmſman. - - - - -	1
Four men to each gun and its oppoſite, and a boy to fetch powder.	35
Seven men at ſmall-arms and occaſional duty. - -	7
	50

A Quarter Bill for a Privateer of Twenty Guns, Nine Pounders; and Four Three Pounders on the Quarter-Deck and Forecaſtle.

On the QUARTER DECK.

The Captain to command the whole. - - -	1
The Maſter to aſſiſt, and work the ſhip according to orders.	1
A Midſhipman to paſs the word of command fore and aft.	1

ON THE MAIN DECK.

A Quarter Maſter at the cun, and another at the helm.	2
The firſt Marine Officer with twenty four muſketeers. -	25
Three men for the two 3 pounders, and a boy to fetch powder.	4

ON THE MAIN DECK.

The Firſt Lieutenant to command the ten foremoſt guns.	1
The Second Lieutenant to command the ten aftermoſt guns.	1
The Gunner to aſſiſt and attend all the great guns fore and aft.	1
The two Maſter's mates to attend the fore-top-ſail-braces, and work the ſhip, forward, according to orders.	2
The Boatſwain's-mate, with two ſeamen, to aſſiſt in working the ſhip, and to repair the main rigging.	3
The Carpenter and his crew to attend the pumps, and the wings about the water's edge, fore and aft, with ſhot plugs, &c.	4
Six men to each of the ten guns on a ſide, and its oppoſite, and a boy to fetch powder.	70

ON THE FORECASTLE.

The Boatſwain to command, with two ſeamen to work the ſhip and repair the fore rigging.	3
Three men and a boy, to fetch powder for the two three pounders.	4
The Second Marine-officer with nine muſketeers. - - -	10
In the barge upon the booms, the third Marine-officer, with eight Muſketeers.	9
In the main-top, five men with a Midſhipman at ſmall-arms, and to obſerve the conduct and condition of the enemy.	6
In the fore-top, 5 men at ſmall-arms, and to repair the rigging.	5
In the mizen-top, 3 men at ſmall-arms, and to repair the rigging.	3
In the powder room, the Gunner's mate with an aſſiſtant, to fill and hand powder to the boys, carriers.	2
In the cock-pit, the Doctor and his mate. - - -	2
	160

HERE

HERE it may not be amiſs to remark, that the people ſhould be quartered to fight neareſt to where they are ſtationed to work the ſhip; that is, the after guard on the quarter deck; the waiſters in the waiſt; forecaſtle men, that are neceſſary, on the forecaſtle, &c. The quarter bill and diſcipline of the crew ſhould be kept from diſorder, as long as poſſible; and when occaſional duty requires people to be let go from their quarters, it ſhould not be done at random, but with judgment, ſuch as will ſuit the occaſion, from the muſketeers, or a man from each great gun, &c. where they can be beſt ſpared to continue in, or be brought to action, in the moſt regular order that is poſſible.

ON PREPARING FOR EXERCISE OR ACTION.

WHEN all hands are called to quarters, every man ſhould bring his hammock, well laſhed up, and ſtow it to the greateſt advantage, to give ſhelter from ſmall arms, (as recommended page 214) neareſt to his own quarters; or to give them to ſome of his meſſmates where they are moſt wanted, that they may know readily where to find them when exerciſe or action is over.

WHEN the hammocks are properly ſtowed, the officers, according to their ſtations and duties, are to ſee the ſhip effectually cleared of all incumbrances, and every thing prepared, ſo that nothing may be wanting, that is neceſſary for exerciſe or action.

THE Lieutenants or mates, with the Gunner on the gun deck, are to get all the hatches laid, except *that* where the powder is to be handed up; a match tub, half filled with water, and four matches in the notches, placed as near midſhip as poſſible, to ſerve two guns and their oppoſites; alſo ſwabs to wet the decks, to prevent the fatal conſequences that may attend the ſcattered and blown powder from the priming of the guns making a train fore and aft, which I have known take fire from the firing of the guns, and do great damage; and which in my opinion has often been the cauſe of blowing ſhips up. And they ſhould ſee that the captain of each gun has his men, powder horn, rope, ſponge, rammer, crows, handſpikes, and train takles, all ready in their proper places.

THE Boatſwain muſt get the yards ſlung, the top-ſail-ſheets ſtoppered, and marlingſpikes ready to repair the ſtanding and running rigging that may be damaged.

THE

THE Carpenters are to get the pumps rigged, and ſhot plugs, with all that is neceſſary, ready in their proper places, to ſtop leaks and repair damages,

THE Gunner, when preparing for action, is to ſee that the charges in the guns are dry, and that there is a ſufficient quantity of wads and ſhot of all ſorts, and cartridges ready filled.

THE Marine-officers are to ſee all the muſketeers at their quarters, with their arms and amunition in good order, for exerciſe or action.

Exerciſe of Great Guns, Mounted on Common Carriages.

THE guns are ſuppoſed to be properly charged, and run out as cuſtomary, but not primed.

First. *Silence, and give Attention to the Word of Command.*

Second. *Take out the Tompions, and caſt looſe your Guns.*

THE tompions to be taken out and laid by, within board; the gun takles caſt off; the breechings rendered through the thimble at the breech, to the middle, ſo long as to let the gun recoil far enough to charge within board; the train tackles hooked ready to bowſe the guns in, after the motion to fire is made.

Third. *Prime your Guns.*

THE cartridge is to be pricked through with the priming wire, and the vent and pan filled with powder, which is to be bruiſed on the flat part of the pan, with the round part of the horn, which ought to be hung up, out of danger from the flaſh of the priming; better a midſhips than to the ſide.

Fourth. *Point your Guns.*

As the voice cannot be heard in action, this ſhould be done by ſigns and motions; and if the guns are fighted as they ought to be, with ſcores filed at the ſides and top of the breech and muzzle, in the direction of the bore, the Captain of the gun is to look by the ſide ſights firſt, and apply one hand to the bed or coin, and make motions with the other hand, upwards or downwards, for the men on each ſide looking at him, with handſpikes to raiſe or fall the breech of the gun, till it points level to the object; then looking

looking along the top ſights, tap with his hand more or leſs on the ſide of the gun, as it requires to be breeched fore or aft by the men with their crows or handſpikes, till it points directly to the object; then he is to make the motion to fire, by flipping the gun, with both hands at a time, jumping briſkly on one ſide abaft the gun.

THE man that is to fire the gun, ſhould ſtrike and blow the match over the match tub clear of aſhes, and ſtand ready on the fore ſide of the gun out of the way of the trucks, ſo that he can ſtrike the fired part of the match on the bruiſed part of the priming, but not over the vent, for that will blow the match out, but if fired with a hot iron, as recommended, the nearer the vent the better.

BEFORE the motion or word of command is giving to fire, the overſeeing officers ſhould frequently look how the guns are levelled, or point to the object, and encourage and inſtruct the people to do all their exerciſe chearfully, expeditiouſly and perfectly, but eſpecially to take all poſſible pains to prevent making the motion to fire before the guns are pointed to the beſt advantage, on the object aimed at, page 212, becauſe on this, ſucceſs in action entirely depends.

Fifth. *Fire.*

AFTER this motion is made, the guns are to be hauled in by their train takles, ſo far as they may be eaſily charged with-in-board, with rope, ſponges, and rammers.

Sixth. *Sponge and Charge your Guns.*

THE Captain of the gun is to ſtop the vent cloſe with his thumb, whilſt a man ſponges it to the bottom of the bore, turning the ſponge round, to extinguiſh any fire and dry up any moiſture left by the powder, which he muſt ſtrike off from the ſponge, when drawn out, againſt the outſide of the gun, and ſhift the rammer's end ready to charge, ſtanding at the fore ſide of the gun. While this is doing, the boy with the cartridge of powder, (who for ſafety is to ſtand as far from the guns as he can till fired) is then to give the cartridge to a man at the after ſide of the gun, who muſt put it in with its bottom end firſt, and the ſeam downwards, as far as he can with his hand: it muſt then be rammed down, till the captain of the gun, with his priming wire in the vent, feels the cartridge, and calls out *home*, or makes a motion to

to that purpoſe: then the rammer is to be drawn out, and the ſhot being according to orders, ready, muſt then be put into the gun with a wad, which are to be rammed to the charge, and ſtruck with two forcible ſtrokes; then the rammer is to be drawn and laid in its place, clear of the gun, and the captain of the gun is then to prick and prime as beforementioned.

Seventh. *Run out and point your Guns to the Object.*

THE Captain of the guns is to look if the object be before the beam; if it is, the guns are to be bowſed out to the after ſide of the ports; but if abaft the beam, to the fore ſide of the ports, that they may be readier pointed at the object, taking care that they do not touch the ſides of the ports, when fired.

THUS the exerciſe ſhould be repeated, with coolneſs and good-nature, till the people are expert at charging and firing; then they ſhould be trained to fire by platoons, or what I think much better, only to fire every other gun; by which a continued fire is kept up, and no part left unguarded when in danger of being boarded and overcome by numbers, and to go from one ſide to the other, as occaſion may require.

EXERCISE OF SMALL ARMS.

THE men are to be drawn up accoutred, with their muſkets on their left ſhoulders, cartouch boxes right before them, and cutlaſſes in their belts on their left ſides: The example of a diſciplined man to perform all the motions in the moſt perfect manner before them, is very neceſſary to make them ſoon perfect.

AFTER ordering ſilence, and to give attention to the word of command, and for the reaſons given, I would recommend, at firſt, only the words of command and motions, as repreſented plate 11th.

First. *Kneel on the right Knee and Prime.*

POISE your muſket, juſt before the lock on the left hand, reſted on the left knee; open your pain with the right thumb; handle your cartridge, and bite off the ſpare end; prime and ſhut your pan with the palm of the right hand, as repreſented plate 11th, figure 1.

Second.

Second. *Caſt about your Muſket, and charge with Cartridge.*

THE muſket is to be lifted with the left hand, and turned on the left ſide, with the but end on the deck and the barrel downwards, ſo that the cartridge may be put into the barrel with eaſe, and the powder ſhaked all out of it, puſhing it down with the fore finger; draw the rammer, ram down the charge, and return the rammer, as repreſented, figure 2.

Third. *Recover your Arms, and make ready.*

BRING the muſket with the left hand round the left knee, with the barrel towards you, place it upright with the but end on the deck, by the right knee, and place your right thumb on the cock, as repreſented figure 3.

Fourth. *Cock, Preſent and Fire.*

EITHER on the knee or ſtanding, as repreſented figure 4 and 5 according to order, or as the ſhelter of the ſtation may require.

Fifth. *Recover, and half cock, your Firelocks.*

PRIME and load on the knee as before; continuing to exerciſe at all opportunities, till the people are become expert in their motions.

THEN it will be neceſſary to exerciſe every man ſingly, by turns, to load and fire with ball at a circular chalk mark, made a foot from the lower end of a board about five feet long, faſtened to one of the fore-top-maſt-ſtudding-ſail-boom ends; ſo that when it is rigged out, the mark may face towards the quarter deck; and to give a ſmall reward, as an encouragement, to the man who hits neareſt the center of the mark.

ON KEEPING A CLEAN BOTTOM.

THE great difference this makes in a ſhip's ſteering, working, and ſailing, makes it a matter of ſuch importance, that all poſſible means ſhould be uſed to prevent the ſhip's bottom from growing foul: and the beſt method that I have experienced for this purpoſe, is to be provided with what I call a caſk-ſcrubber, as repreſented plate 9, figure A, which I have often uſed in different ſhips with ſucceſs, when at an anchor, and in calm

weather on the open ocean. I had theſe ſcrubbers made of elm board about an inch thick and twelve broad, the middle part of the frame juſt to fit a ten gallon caſk, that was laſhed to the battons at each end, and the long ſquare ſpaces on each ſide of the caſk were filled with birch broom ſtuff, which projected about ſix inches without the frame, and wedged faſt towards the ends with long wedges againſt boards that ſlide with ſmall tenants at each end in a groove to keep the birch faſt and firm, for ſcrubbing the bottom, even cloſe down to the keel, and the iron work which unites the two parts by a joint that they may the more naturally play to the curved or rounding parts of the ſhip's bottom, with the ſlings and the ropes faſtened to the eye-bolts; all which may be perceived and underſtood by looking with attention at the figure that repreſents that ſide of the ſcrubber that is hauled next to the ſhip's bottom.

IN uſing this caſk-ſcrubber, we had a block laſhed under the bowſprit end, and another on the driver boom, rigged out right aft, and a ſingle rope reeved in theſe blocks, and made faſt to the ſlings marked 1, 2, in the figure, and juſt long enough to veer and haul the ſcrubbers along the bottom fore and aft cloſe to the keel, another rope bent to the lower part of the ſcrubber, as marked 3, and hauled tight under the bottom, and made faſt to the inſide of the boat's main thoft, when the upper part of the ſcrubber even with the water's edge a-midſhips on the other ſide, then the people were ordered to walk fore and aft with the rope to the ſcrubber, till it came up to the water's edge each way, the boat moving the ſame way with the ſcrubber, the people in her helping by puſhing their hand againſt the ſhip's ſide, till the firſt depth is thought to be clean enough, then the people in the boat haul by their rope the ſcrubber a depth lower, by which, and the empty caſks, it is confined and preſſed to the bottom at the different depths, till it is ſcrubbed clean down to the keel; and even the keel itſelf, by the rope going fore and aft under it.

WHEN a ſhip's bottom can be kept clean by ſuch eaſy means, I think it ſhould be reckoned a great reproach to thoſe who neglect it, becauſe ſucceſs may depend upon it, not only in time of war, but in peace on ſouthern voyages, eſpecially in the *African* ſlave trade, where I have known a ſhip that loſt the whole adventure of her voyage, and came with her bottom covered all over with cluſters of mixed ſhell-fiſh, projecting from the bottom, and in diameter about ſix inches each, made up of large barnacles, muſcles, and oyſters, as repreſented fig. B, plate 9, which naturally

turally increaſed greatly the ſurface and ſtop-waters of the bottom, and would make the ſhip ſail one half the diſtance leſs than ſhe might have done, had her bottom been kept clean as abovementioned, by which ſhe might have made her paſſages in half the time, which might have made a gaining inſtead of ſo great a loſing voyage; for which reaſons, rather than ſuch a neceſſary work ſhould be neglected, I think it ſhould be made a part of the commanders inſtructions ſo to do it, when it cannot be done by other more effectual means. We had a late inſtance of a large ſharp built ſhip from *Africa*, in this foul condition, that could not be ſteered into *Liverpool*, but was loſt entirely owing to her bottom not being ſcrubbed during the voyage. Where iron work is not provided to make a ſcrubber of this ſort of two parts as abovementioned, I have thought that one part might be made to anſwer the purpoſe, and ſlung with ropes without any iron work.

On the Sailing of Letter of Marque Ships or Privateers.

SITUATIONS, circumſtances, and times vary ſo much, that no eſtabliſhed rules can be fixed, yet, I preſume ſomething may be ſaid that may prove of ſome ſervice to inexperienced people in this trade.

IT is a common ſaying among commanders of ſhips, that it is better to break their owners than their orders, which are commonly, on theſe occaſions, to proceed with all poſſible expedition to the deſigned ſtations or tracks of the enemies trading ſhips, to take prizes, &c. But it ſhould be conſidered, for the ſame reaſon, that their cruiſing and armed trading ſhips, may be expected to be met with in the track of our trading ſhips; which makes it requiſite to come to immediate action; and if the ſhip and people are unprepared for it, for want of being properly ſtationed, and not having had ſome exerciſe in their duty of fighting, as beforementioned, page 219, it may prove the loſs of the whole. And, as a further inducement, to get the ſhip and people prepared as ſoon as poſſible for action, I can ſay, from fortunate experience, that the richeſt prize I have been at the taking of, in the courſe of two wars, was upon the ſouth coaſt of *Ireland*, which track they had made choice of, to avoid our cruſing ſhips on the *French* coaſt,

and to meet with ſome of our merchant ſhips in their way, one of which they had taken.

On Stationing and Exerciſing Merchants Ships Crews for War.

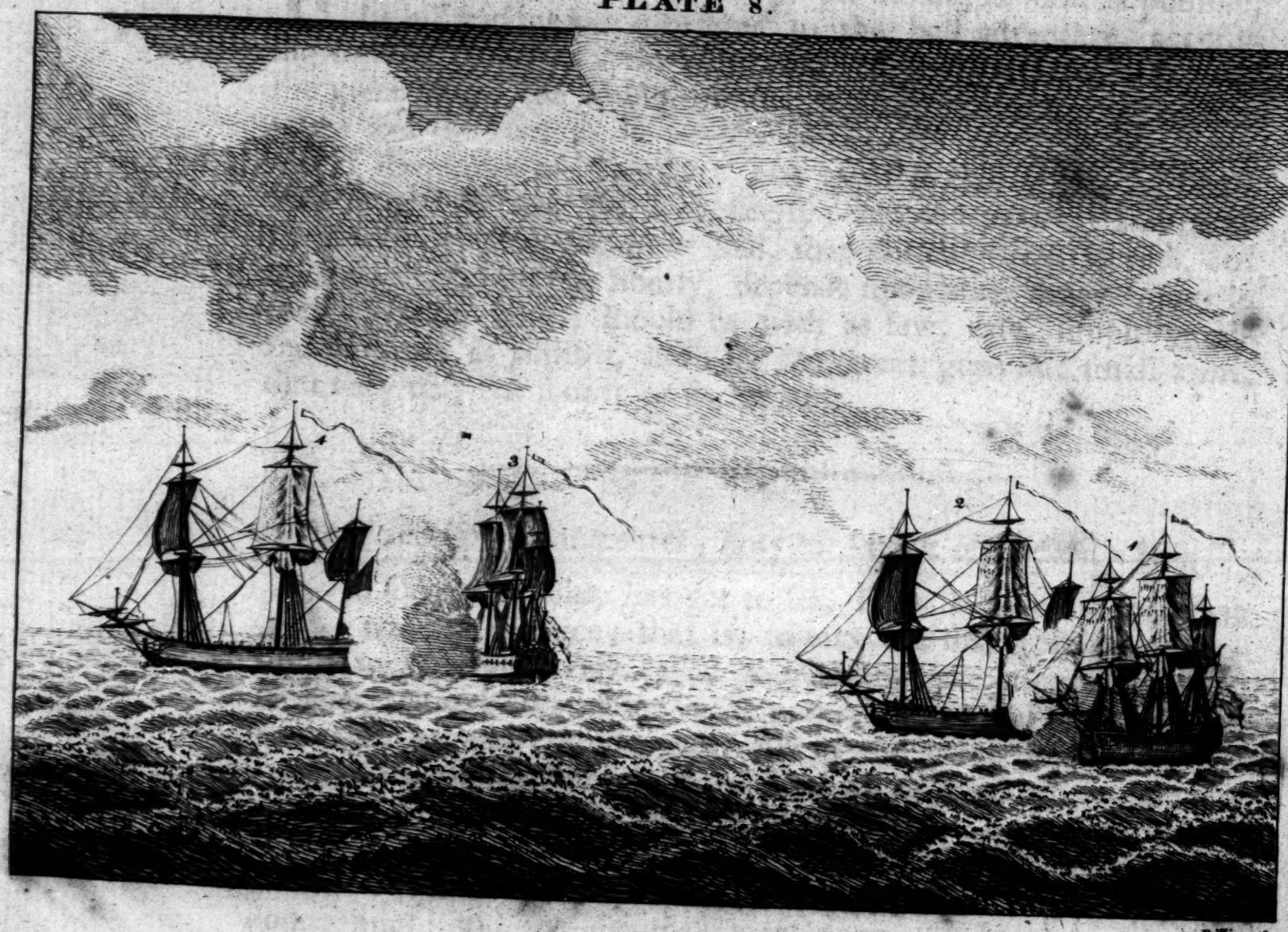
FOR the above reaſons, the people ſhould, as ſoon as poſſible, be all ſtationed or quartered to the beſt advantage, according to their capacities; the oldeſt and beſt ſeamen to be captains of the great guns; the young, nimble, and expert, to the rigging and tops; and the boys to be powder carriers for the great guns, &c. and as they come on board, if it is poſſible that it can be done, they ſhould be exerciſed accordingly; and to encourage and make them willing, they ſhould be told, that not only their ſucceſs, but their ſafety, as well as liberty, depends upon their being expert in their exerciſe, which ſhould be with as few, eaſy, ſimple words and motions, as poſſible, both for the great guns and ſmall arms, that they may the ſooner be fit for action.

On Exerciſing Manœuvres; how to Attack or Defend a Ship.

AS ſoon as the ſhip has got to ſea, I would recommend what was my practice; that is, to take the firſt poſſible opportunity to have all hands called to quarters; the officers, in their ſtations, to have every thing made properly ready and fit for action; to have a general exerciſe, not only of the great guns and ſmall arms, as abovementioned, but the method of working and managing the ſhip, to take the advantage of the openings, that I know, from experience, often occur, in attacking, or being attacked by another ſingle ſhip; which ſhould be ſtudied by every commander; and the deſigned manœuvres ſhould be taught the people in their general exerciſe, that they may know how to act, and move regularly from one place and ſide to the other, as the occaſion may require, without confuſion, which is always the conſequence, when the intention and management of the manœuvres are not known to the people in general.

FOR theſe reaſons, as ſoon as poſſible, I uſed to make known to them, that when a ſhip, of nearly equal force, brought to with a deſign

PLATE 8th.



Billings Sc.

a deſign to fight us, my intention was not to run directly along ſide, and lie to like a log, and depend upon mere battering, with one ſide only; nor upon the ſtern chaſe guns. When it is found that there is no choice of running from a ſhip of much ſuperior force chaſing us, and when their beſt ſailing is upon a wind, it is a common practice for them to run up and bring to under the lee, in a triumphant manner, depending on their ſuperior power, and commonly demanding immediate ſubmiſſion, without expecting any reſiſtance. The deſigned manner of reſiſting or attacking, I always endeavoured to conceal as long as poſſible, as mentioned page 205; and theſe two caſes give all the advantages deſired by my method. Begin the attack upon the weather quarter, ſhooting the ſhip up in the wind, with the helm a lee, till the after lee gun, with which we begin, can be pointed upon the enemy's ſtern; then fire the lee broadſide, as it may be called, as repreſented in plate the 8th. The ſhip (figure 1) begins the attack upon the ſhip (figure 2) when the top-ſails are thrown aback, with the helm a lee, boxing the ſhip round on her heels, as mentioned in box-hauling, page 86, ſo as to bring the wind ſo far aft, that the ſhip may immediately be ſteered, cloſe under the enemy's ſtern, as the ſhip (figure 3) is repreſented, running under the ſtern of the ſhip (figure 4), with particular orders to begin with the foremoſt gun, to rake them right fore and aft with the great guns, as they paſs in that line of direction, all aiming and firing to break the neck or cheeks of the rudder head, the tiller ropes, blocks, &c. ſo as, if poſſible, to deſtroy the ſteerage tackle; which deſign, if it proves ſucceſsful, takes the management of their ſhips from them, ſo that ſhe muſt lie helpleſs, for a time, in ſpite of their endeavours. When the aftermoſt gun is fired, put the helm hard a weather to bring the ſhip by the wind; and then ſtand off on the other tack, to keep clear of their lee broadſide, and act according to their motions, and the experience of the effect your attack has had upon them. If they continue to lie to, either renew the attack again, in the ſame manner, as ſoon as the ſhip will fetch the weather quarter again, or make ſail off to eſcape, if it is found that the great inequality of their ſuperior force admits of no poſſible chance of conquering them. And although this manœuvre may not have given this advantage (which in my opinion, ought always to be attempted, and not to ſubmit tamely, though a ſhip is above double the force) yet the power of their broadſides may be chiefly avoided by it.

But when the inequality of force is not ſo great, but their is a poſſibility of conquering; and if the ſucceſs of the firſt attack is perceived to oblige the enemy to continue lying to, in order to repair the damage done their rudder or tiller, &c. then the blow ſhould be followed, by renewing the attack again with all poſſible expedition, in the ſame manner, which gives the opening, not only to fire the whole round of great guns to advantage, but, alſo, to the marines and top-men to fire their ſmall arms, at the ſame time, to great advantage ſo as to do the moſt execution poſſible by firing and raking them fore and aft through their moſt open and tender part, the ſtern, with the leaſt riſk poſſible from the enemies guns, and therefore gives the greateſt poſſible chance, that I know of, to make an eaſy conqueſt, eſpecially, if ſo lucky as to deſtroy, and prevent the recovery of, their ſteerage. A ſhip of much ſuperior force may be brought to ſuch a diſtreſt condition as to be obliged to make a ſubmiſſion for want of the helm to command her, therefore when an opportunity offers, in fighting, this ſhould be always aimed at.

But ſuppoſe the enemy, laid to as abovementioned, find themſelves not much hurt by this manœuvre, and that you have not ſucceeded in deſtroying their ſteerage, and therefore you may expect that they will immediately tack, or ware ſhip, and ſtand after you, depending on their advantages of ſailing faſter, and ſuperior force, ſhall run up along your lee ſide, expecting by making a general diſcharge of their ſmall arms and great guns (charged with ſuitable ſhot) on your deck, which lies open to them by the ſhip's heeling, to deſtroy your people and to make you ſubmit? When this is likely to be their deſign, orders ſhould be given to your people to keep themſelves as ſnug under ſhelter as poſſible from their ſmall ſhot, till their general diſcharge is over; then if the ſhip is found not ſo diſabled, but that the top-ſails can be thrown aback, make a general diſcharge, from the lee ſide, of the great guns, loaded with round ſhot only, pointed to the weather ſide of the enemies bottom, amid-ſhips to one point, at the water edge, and box-haul the ſhip to run cloſe under their ſtern, aiming at raking and deſtroying their ſteerage, with the other broad ſide; then ſtand off on the other tack as beforementioned, and act according to the circumſtance and the condition you find yourſelves in, compared with the appearance of that of the enemy and their motions, who may be obliged to continue on the other tack to repair damages

about

about their rudder, or to ſtop their leaks in the weather ſide of their bottom, if your aim has proved ſucceſsful.

On an enemy of force making a running fight.

But when an enemy's ſhip of force makes only a running fight, if there is no neceſſity to cut them off from the ſhore or from the ſhelter of other ſhips, &c. and you have the advantage of ſailing faſter, the moſt ſure and likely method to make an eaſy conqueſt with the leaſt hurt to yourſelves, or their ſhip, (your expected prize,) is to run cloſe up and ſhoot or ſheer your ſhip acroſs their ſtern each way, making a general diſcharge of all your force, firſt with one broad-ſide, then the other, always aiming with the great guns at the rudder head, and ſteerage tackling, for the reaſons given; that if the ſhots miſs the rudder, &c. by raking the ſhip fore and aft through the ſtern, they may do the greateſt execution poſſible to diſtreſs them ſo as to make a ſubmſſion.

On this occaſion, when it blows freſh, and obliges to carry a preſſing ſail large, or before the wind, to make the great guns as ready as poſſible, and prevent their being fired too low, all their breeches ſhould be laid quite down in the carriage, and if your ſhip is crank, the yards ſhould be braced, ſo as to ſhiver the ſails at the time each broad ſide is fired.

On exerciſingwith a caſk to poiut the guns and fire at.

In all theſe manœuvres, when the whole round of great guns are deſigned to be fired, care ſhould be always taken to leave two or more men, as it may require, to charge each gun again when fired on one ſide, whilſt the others move over to fire the guns on the oppoſite ſide; that neither ſide may be left unguarded; all which with every other advantageous manœuvre that may be deſigned to be put in practice, in action, ſhould be taught the people along with the general exerciſe of great guns, and ſmall arms (as, before hinted, that I have done), by throwing a tight empty beef caſk overboard, making it the object of attack, for all the guns to be pointed at, when performing the above deſcribed or other intended manœuvres about it; firſt, by running a little way large from it; then haul the wind, tack ſhip, and ſtand towards it, keeping it about three points on the lee bow till within a half cables length, or muſket ſhot of it; then put the helm a lee, and ſhoot the ſhip up in the wind with the top-ſails aback, till the after gun can be pointed to the caſk; then give the word of command to fire, when there is a fair opening to make a general diſcharge, both below and aloft on that ſide, as repreſented plate the 8th, the ſhip figure 1, beginning the attack on the weather quarter of the ſhip figure 2, as before deſcribed, which the caſk

may

may be ſuppoſed to repreſent, as well as the ſhip figure 4. When you have box-hauled your ſhip, and run cloſe paſt the caſk to make a general diſcharge from the other ſide, as repreſented by the ſhip figure 3, then bear round away from it, ware, and haul the wind on the other tack, till you can tack and fetch up to it again to repeat this, or perform any other manœuvres that may give an advantage to attack or defend a ſhip laid to, or ſailing upon a wind, as abovementioned. To perform the manœuvres of attacking an enemy that makes a running fight large, or before the wind, you have only to turn far enough to windward of the caſk, to give room in ſailing down to it to bring the ſhips broadſide to point to it each way. But to perform this manœuvre to the greateſt advantage, with the leaſt loſs of time, and the ſhip's way through the water, (which may be of great importance on this occaſion to keep cloſe up with the enemy) all the great guns ſhould be run out cloſe to the after part of the ports, that they may be pointed as far forward as the ſides of the ports will admit, and elevated as the heeling of the ſhip, when brought to, to fire, may require, as abovementioned. And particular orders ſhould be given for the aftermoſt guns on each ſide to be fired firſt, as ſoon as they can be brought to bear upon the enemy, becauſe, then the ſhip need not be brought any more to, but ſteered in that direction till the other guns are fired; then ſhift the helm to ware, to bring the other broadſide to bear, &c.

After the people have been thus diſciplined, it is neceſſary to let them ſmell powder, as it is termed. And a little ammunition ſpent in exerciſe it is allowed, may be the means to ſave a great deal expended to little or no purpoſe, in action; therefore I uſed to allow a ſmall charge of powder for the round of great guns, with ſtone ballaſt for ſhot; and the muſketeers two charges with balls each; and give them a fair chance, by theſe manœuvres to fire both broadſides, and ſmall arms at the caſk; if they ſunk it, all hands to have an allowance of grog, as it is called, but if they did not ſink it, to have the trouble and mortification to hoiſt out the boat and fetch it on board to ſerve another time. By ſome ſuch methods only, it is poſſible to make the people expert in their duty to fight a ſhip to the greateſt advantages. But two ſhips in concert, exerciſing the different manœuvres, by turns, as might be agreed upon, and making a ſham fight with powder only, would contribute moſt to anſwer this purpoſe, and to find out the beſt

trim

trim for their ſhips for ſailing, by the people moving fore and aft with as many ſhot as they all can carry with them, &c.

ON A SHIP CRUISING IN HER STATION.

SITUATIONS and circumſtances are ſo variable, that no certain rules can be laid down for this purpoſe: yet I think hints may be given that may contribute towards getting ſight of, and falling in with the enemies trading ſhips, when got into their tract, on which ſucceſs intirely depends.

CRUISING the war before laſt in the employ of that great, but unfortunate hero, *Fortunatus Wright*, in the *Mediterranean* ſea, where the wind blows, generally either eaſterly or weſterly; that is, either up or down the ſtraits; it was planned, with either of theſe winds that blew, to ſteer up or down the common channels the common courſe, large or before the wind in the day time without any ſail ſet, that the enemy's trading ſhips, a ſtern, crouding ſail with this fair wind, might come up in ſight, or we come in ſight of thoſe ſhips a head that might be turning to windward; and at ſunſet if nothing appeared to an officer at the maſt head, we continued to run five or ſix leagues as far as could then be ſeen before we laid the ſhip to for the night, to prevent the ſhips a ſtern coming up and paſſing out of ſight before the morning, or our paſſing thoſe ſhips that might be turning to windward; and if nothing appeared to an officer at the maſt head at ſunriſe, we bore away and ſteered as before. And when the wind blew acroſs the channels that ſhips could ſail their courſe either up or down, then to keep the ſhip in a fair way; in the day time to ſteer the common courſe under the courſes and lower ſtay-ſails; and, in the night, under topſails with the courſes in the brails, with all things as ready as poſſible for action, and to take or leave what we might fall in with in the night.

On cruiſing without ſail in the day, and under topſails at night.

MANY other advantages attend cruiſing without any, or but with low, ſails ſet. As abovementioned in the day time and fine weather, when other ſhips are crowding with all their lofty ſails ſet, they may be ſeen at twice the diſtance that you can; which gives you the opportunity to ſee them a long time before they can ſee you; and to take their bearing by the compaſs, and obſerve how they alter; by which it may be perceivable how they are

ſteering, and you may conſult what is beſt to be done, if it is too late in the day to give chace; which ſhould always be conſidered. For three maſt ſhips, in fine weather, with all their lofty ſails ſet, may be ſeen from each others maſt heads ſeven leagues diſtance; which muſt make a ſeven hours chace, at three miles an hour difference in the ſhips ſailing, which is a great deal with a leading wind; and if the chace happens to be to windward, muſt make it ſtill longer in proportion of time to come up with her; and when they perceive they are chaced, and think themſelves in danger of being taken, they will naturally uſe all poſſible means to eſcape out of ſight, by altering their courſe in the dark, if they cannot be got near enough for you to keep ſight of them in the night.

Not always to give chaſe at the firſt ſeeing a ſhip.

FOR theſe reaſons, without the time, ſituations, circumſtances, and appearance require you immediately to give chace with all your ſail at the firſt ſight of a veſſel, it often happens, that you may ſtand a much better chance to ſpeak with the veſſel by endeavouring to waylay and conceal your deſign and ſhip from them; which may be done even in the day time, with all the ſails furled as beforementioned, till within about four leagues diſtance, when it is computed a ſhips hull, in a clear horizon, begins to appear above it. When this concealment can be made, and all is ready prepared to take or leave, and you can fall in with the expected enemy in the night, or early next morning, if they are found unprepared for action, it muſt give you a great advantage over them. But when you cannot be concealed from enemies veſſels in ſight, that may be coming with a fair wind towards you; then it ſhould be conſidered, whether, inſtead of giving chace with all your ſail ſet in fine weather, it may not be better to diſguiſe your ſhip, to appear as an inoffenſive neutral ſhip, by getting your fore and mizen-top-gallant-yards down, and the maſts ſtruck with only their heads above the caps, as mentioned page 55, and either ſtand upon the wind, with the main-top-gallant-ſail ſet, if not noticed, till, by tacking, you can fetch near the intended chace; or, to ſteer near the ſame courſe with them, with ſtop-waters towed in the water; which I have ſeen done with ſucceſs to make the ſhip ſail ſo comparatively ſlow as to induce an enemy to come faſter up with you, than you could with them by chaſing.

IN

IN chaſing, all poſſible pains ſhould be taken to ſet and trim the ſails to the beſt advantage; as has been mentioned on that ſubject; and to conſider the properties of your ſhip. If ſhe excels moſt in ſailing upon a wind, the chaſe ſhould then be kept upon your weather bow, to prevent her getting to leeward of you; but if you excel moſt in ſailing large, and not upon a wind, the chaſe ſhould be kept upon the lee bow to prevent her getting to windward of you; regulating your motions according to the motions of the chace, that will naturally endeavour to make uſe of the ſame advantages of beſt ſailing; and if it is a light ſhip, or lightly loaded, ſhe will ſail better large than upon a wind; and if a deep loaded ſhip, better upon a wind than large, &c. all which deſerve notice. To chace to the beſt advantage, and as ſoon as it can be done, the helms-man ſhould ſee, and be directed, how to keep and ſteer ſteady by the chace, (independant of the cun) which is known to help a ſhip's ſailing to come up with the chace.

BUT it often happens in chaſing, that night comes on; which makes it very uncertain how long, or whether the chace can be ſeen or not, though many may pretend to ſee her plain, long after ſhe has been loſt ſight of by the commander, who ſhould not depend upon other peoples eyes without trying every now and then, whether they point to ſee the chace, in one and the ſame part of the horizon, when the ſhip is privately ordered to be wared about from her courſe a point or two from the compaſs each way; and according as they agree or diſagree from this rule, either to continue or leave off chace, and crowd ſail to get a head, and way lay the chace, in the way ſhe ſeemed to be bound; which from experience I can ſay gives the beſt chance of falling in with her again.

ON TOWING AND ROWING A SHIP IN CHACE.

CHASING with little winds and in calms, may often require both to tow and row the ſhip with oars. Therefore, to do it in the moſt advantageous manner, deſerves notice. When towing a ſhip to make her ſteer and work, it may require the tow rope not only from the bowſprit end, but from the jib-boom end, which will give more power, in proportion as it is farther from the center of the ſhip's turning motion, to pull her about; but when towing to give the ſhip moſt headway poſſible, the tow rope ſhould

be made faſt no higher than is neceſſary to keep it clear of the water.

To row the ſhip with oars, the oars ſhould be made ſuitable to the room the ſhip affords to row and ſtow them. In the *Liverpool* Privateer, beforementioned, we rowed with eleven oars on each ſide; and ſculled with two, run out right aft, after the manner of the *Chineſe*. And in order to add more power, by more people pulling all together at the oars on each ſide, and prevent the confuſion and hinderance that is occaſioned by the people's not pulling all together, we had ſwifters for each ſide, made of ſingle ropes, with gromits in them, at the ſame diſtance of the row ports from each other; and put on the handles of the oars ſo, that men could pull between the oars by theſe ſwifters; which after a little practice, ſoon made all the people pull completely together.

THE two ſculling oars abaft, were made crooked or curved a little, with the flat of their blades bending downwards, and an iron ſocket nailed to the under part of the oar at the port, when the blade was flat in the water; and a ſhort bolt, tapered and filed like a wood ſcrew, with a round head, was fixed in the middle of the ports for the oars to turn upon; and ſtaples in the deck, right under the handle of the oars, to hook a line with a hole in the handle of the oar that is reeved through with a bend that bears the ſtrain, whilſt the men ſcull, by ſtanding on each ſide of the handle of the oar, and only have to pull to, and puſh from them, with all their ſtrength, which makes the blade cant and act, ſlanting downwards into the water, each way, with great power to give the ſhip headway; and may likewiſe help to ſteer the ſhip and bring her about from one tack to the other, when it cannot be done by the rudder, and will ſweep a ſhip's ſtern about as occaſion may require, when engaging in a calm. The comparative power and effect of ſculling oars, to force a veſſel through the water, is indiſputably proved in *China*; where the people appeared to me no ways expert in their navigation, except in this method of ſculling all their numerous river veſſels and paſſage boats, great and ſmall, without any ſail or rudder; and this they do in a more dexterous, eaſy, and expeditious manner, in my opinion, than in any other part of the world that I have ſeen. I have obſerved, with pleaſure, their veſſels with 20 tons of goods, and room to accommodate their families, ſculled by two men only, from the city of *Canton* (20 miles) to our ſhips, ſtemming and

On ſculling Oars.

On ſculling in China.

ſculling

ſculling againſt the tide, running above two miles an hour, and laying the ſhip on board in a ſafe and eaſy manner. And not only their large river veſſels, but their ſmall boats are moved very faſt through the water by this method of ſculling. I was one in a fine eight oar'd pinnace that was beat with eaſe, and laughed at by two men in one of their common bumb-boats, in ſpite of our utmoſt endeavours; this therefore deſerves notice, and might in my opinion be brought into uſeful practice among us, on many occaſions, in boats in narrow rivers and canals, to land numbers of men where there is not room to row with oars; and in our whale boats, &c. for with the very power they ſcull the veſſel a head, they ſteer her at the ſame time; which muſt on this account be much better than a rudder, that ſtops water, as has been obſerved on rudders. I cannot forbear here remarking that theſe *Chineſe* ſculling veſſels are built upon good principles to anſwer their purpoſe, as all veſſels that are to be moved with oars or paddles only, ought to be, having flat rounding bottoms, with flanging projecting bows and ſterns, without keel, ſtem or ſtern-poſt, to hinder their ready turning; and drawing ſo little water, they are eaſily made to ſkim, in a manner, at a great rate over the ſurface of it, where the water gives way much eaſier than it can do at a greater depth; and their method of ſculling makes them (as much as poſſible for art) to imitate the nature of *Porpoiſes*, which ſcull with their horizontal tails ſwifter than any other fiſh we ſee at ſea, where they frequently ſeem to ſport and mock a ſhip when ſailing at the rate of ten miles an hour, and will ſwim, as may be obſerved, ſculling with their horizontal tails, acroſs and acroſs the ſhips bows, at ſuch an angle, that they cannot go leſs than thirty miles an hour; which muſt be allowed to make much in favour of the *Chineſe* method of ſculliug their veſſels, inſtead of rowing them as we do with oars, which are levers; and our method of applying their power in rowing, will in my opinion never be excelled, by any complicated machinery; which has been often tried, at great expence, without ſucceſs.

On Porpoiſes ſculling with their tails.

NOW

NOW we may ſuppoſe a ſhip to have come up ſo far with her chace, as to preceive them to have the appearance of enemies, and preparing for action. Then the appearance of their force and motions, ſhould be ſtrictly obſerved by the commanding officer; and he muſt proceed accordingly, to make all neceſſary preparations in good time againſt the worſt that may happen; guarding againſt being ſurprized unprepared by any ſham appearance and motions that may be uſed to deceive, as happened when I was in a cruizing ſhip in the war 1746, when the ſtarboard ſide of our mizen-top was ſhot away by the enemy before our commander would permit all hands to be called to clear ſhip for action.

WHEN come ſo near to the enemy in chace, that they prepare and fire their ſtern chace guns, (which is a ſign of weakneſs and fear, and which gives joy to the chaſing ſhip) though it muſt be allowed to give them a chance of ſhooting away ſome of our maſts, and helps their ſhip forward; but as ſucceſs depends entirely upon getting cloſe up, to have them at command, therefore, without ſome good reaſon, you ſhould not be tempted to fire your bow-chace guns, becauſe they will ſtop your ſhip's headway ſo much as may occaſion the loſs of your expected prize.

BUT when the chace is perceived to be a ſhip of force, preparing and clearing ſhip for action without running out their ſtern chace guns; then all poſſible pains and expedition ſhould be uſed to clear ſhip, and make all the neceſſary preparations, that the circumſtances of the time and attack may ſeem to require; to have the yards ſlung, the top-ſail-ſheets ſtoppered, and to leave nothing to be done but to haul up the courſes to come regularly to action.

ON MANOEUVRES IN ACTION.

On running end on to begin the attack

SUPPOSE you are chaſing with the wind large, and that the enemy hauls up his courſes and brings to, in form of battle, with the main-top-ſail aback, &c. as if he thought it moſt advantageous to begin the attack by firing his broadſide to rake you fore and aft, as you are running down large, right end on towards his broadſide, which in my opinion, is a manœuvre that by *Britons* ought never to be refuſed, though it was given as

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a reaſonable excuſe, for a late unfortunate Admiral's not running right down upon the enemy, who laid to waiting for him; but I can ſay from reaſon, as well as experience, that when running right down upon the enemy, we have received two broadſides in the time, without receiving any damage of conſequence: for it ſhould be conſidered, running in that direction, a ſhip is not above a quarter part as big an object for the enemy to hit, as when broad ſide to; and the ſhape of the bows and built making that the ſtrongeſt part of a ſhip, may deflect many ſhot that may hit her in that ſlanting direction.

THEREFORE I think it a point of duty on this occaſion, to run right down, and bring to with the top-ſails aback, cloſe on the enemy's weather quarter, and begin the attack by making a general diſcharge from the lee ſide; then box haul the ſhip, and run cloſe under their ſtern, and make a general diſcharge from the other ſide, aiming at raking them fore and aft; and if the power of the enemy appears to require it, put the helm hard over, to bring the ſhip by the wind on the other tack, till you can fetch the enemy's weather quarter again (if they continue to lie to); then put the ſhip about, and repeat the attack by the ſame manœuvre, as before fully deſcribed, (as well as that of attacking a ſhip of force that makes a running fight) in the exerciſe of theſe manœuvres beginning at page 228. A fore-ſtay-ſail, as before mentioned, is abſolutely neceſſary for a fighting ſhip to make her manageable on theſe occaſions, when her courſes are brailed up.

BUT it muſt be allowed, that a ſhip is liable to be diſabled in her maſts, yards, rigging, &c. ſo as often to hinder the performing the above mentioned manœuvre; yet all advantages and openings are to be taken, and none given to the enemy in fighting; and I know from experience, that our people fight much more to advantage, in proportion as they are brought near to the enemy, who we will ſuppoſe continues lying to, to fight, and that your ſhip may be diſabled from, or think it neceſſary to perform the above-mentioned manœuvre; yet even then, I would recommend to begin the attack cloſe upon the enemy's weather quarter, (as the ſhip figure 1 is repreſented, attacking the ſhip figure 2, plate the 8th) and only by backing and filling the ſails, as the circumſtances of your own, and the enemies ſhip and people may be obſerved to require.

IN performing this manœuvre, of backing and filling when the enemy lays his ſhip to, to fight, as laſt mentioned, it ſhould be made

On attacking by backing

and filling the ſails.

made a certain rule, on your ſhip getting ſternway by backing the ſails, that the helm ſhould be put hard aweather, to make her back the farther a-ſtern, before ſhe loſes her ſternway, ſo as to gain the more room to get ſufficient headway upon your ſhip, to be more under command of the helm to ſteer and ſhoot her with pleaſure, either on the lee or weather quarter of the enemy, who lying to with their helm a lee, is under no command, but alternately comes to and falls off from the wind; which being obſerved, you may take the advantage and ſhoot your ſhip up in the wind cloſe under and acroſs their ſtern, raking them fore and aft with what may be called your lee broad ſide; and after that, the ſhip may be backed and boxed off at pleaſure, to fill and ſhoot up upon the enemy's lee quarter, to diſcharge your weather broadſide, and back all the ſails, eſpecially after ſail, with the helm a-weather when the ſhip gets ſternway, to make her back the farther a-ſtern of the enemy, where all the guns may be loaded again, and all things made properly ready with more ſafety to repeat the attack in the ſame manner if the enemy continues to lie to; which may be done by the above management; for in making the ſtern board with the helm a-weather and the after ſails flat aback, your ſhip rather gains ground to windward, whilſt the enemy, with the main-top-ſail only aback, drives to leeward, and ſhoots a head; ſo that when your ſternway is done, by filling your after ſails, your ſhip may be luffed up to fetch and luff up under the enemy's ſtern again, to act as their ſituation and behaviour, compared with your own, may admit and require.

THIS manœuvre of backing and filling, which may be eaſily continued in practice as long as the maſts and yards ſtand in a three maſt ſhip, gives a great advantage when attacking, or being attacked by ſloop, ſchooner, or any row galley; as veſſels, ſo rigged, cannot back their ſails; and then it may be neceſſary to have both ſtern and bow chaſe run out to prevent their raking or running you on board in thoſe unguarded parts.

But let us now ſuppoſe that the enemy is found but of equal force to yourſelves; yet it is ſtill the duty of all commanders to endeavour by all prudent means, to avoid being unneceſſarily expoſed to the enemy's ſhot; and to obſetve and take all advantages that offer; beginning and continuing the attack by manœuvres, as long as the enemy's management admits of it, as beforementioned; attacking them cloſe under the ſtern, and quarters; and not out of bravado, to run up along ſide to try their ſtrength, until by your

ſuperior

ſuperior conduct and bravery, and by appearances, you have weakened and diſtreſſed them to ſuch a condition, that it is but reaſonable (to ſave lives and property,) they ſhould make a ſubmiſſion when threatened with your being prepared for and determined in their total deſtruction, if they refuſe to ſubmit.

On keeping the enemy always before the beam, and not to board before driving them from their cloſe quarters.

BUT when an enemy on coming near proves much inferior in force, and ſtands no common chance to reſiſt your power, then intereſt as well as humanity to preſerve both men and ſhips from harm, requires to run up to their quarter, and demand immediate ſubmiſſion; but take care always to keep them before your beam, which gives an opportunity to obſerve their motions and behaviour, and your own people's at the ſame time, and prevents their taking notice of any of thoſe advantages that have been deſcribed, whereby a ſhip of ſmall force may hurt, or eſcape from, one of much greater power. And ſuppoſe they refuſe to ſubmit, and take ſhelter from your ſhot in their cloſe quarters, and expect to be boarded to take the advantage to deſtroy your people from thoſe quarters? Without ſome very urgent motives, I would never ſacrifice men to board them, and fight againſt the great advantages that cloſe quarters afford, but manage ſo, as to lay your ſhip's broadſide right acroſs their ſtern, and there, if poſſible, to grapple and ſecure them, by making faſt to each of their quarters, and raking them through the ſtern, fore and aft, to drive them from their cloſe quarters; after which your people may be put on board to take poſſeſſion; and take their chance to oblige them to make a ſubmiſſion, to prevent farther deſtruction of the ſhip or people, which both intereſt and humanity demand from the conquerors, as far as is conſiſtent with their own ſafety.

ON TREATING PRISONERS OF WAR.

AFTER enemies ſubmit, and ſurrender themſelves priſoners of war, then not only all hoſtilities, but treacherous deſigns ſhould immediately ceaſe on both ſides; and for the health and happineſs of the whole, while they are obliged to live together in one ſhip, the priſoners ſhould be treated with all the lenity and liberty that ſafety and good order will admit of; and not to aggravate and augment their unfortunate ſituation, by cruel uſage and cloſe confinement below, to breed diſorder and diſcontent, and

drive them, out of fatal neceſſity, to deſperate attempts for their liberty and to breathe in purer air.

YET it muſt be allowed, when priſoners of war have their liberty, it requires extraordinary care and caution to guard againſt giving them any opening or advantage, that may induce them to attempt riſing to take your ſhip from you. In the war 1747, cruiſing in the *Mediterranean* with the priſoners of three *French* prizes on board, at their entire liberty upon deck, apprehending no danger from them; upon an occaſion, I imprudently ordered all our ſails to be clued up, and all our people upon deck, to go up and hand them with all poſſible expedition; one of the *French* captains thought to avail himſelf of the advantage of our people being moſtly aloft; I providentially however perceived he was going to give the alarm for his people to riſe and take the ſhip, and putting my hand in my pocket, took hold of my pocket piſtol, and ran up cloſe to him, and told him coolly that he ſhould be the firſt that ſhould die by the attempt; which ſtopped his proceeding; and I calmly ordered our people to come down as faſt as poſſible; which they did; and made me very thankful to Providence for the eſcape from this danger; which I thought afterwards, might have been avoided by ordering their ſeamen to go up aloft, mixed with ours, to do the working part of duty as ſuch occaſions may require; which cannot be thought unreaſonable whilſt they are priſoners of war, and are allowed the ſame proviſion and liberty as their conquerors, as far as is conſiſtent with ſafety.

THEREFORE to enjoy this mutual advantage, all ſuch ungrateful and unfair attempts ſhould be diſcountenanced and aboliſhed from amongſt civilized nations. I farther learned, from this man's attempt, what little dependence is to be put on ceremonious profeſſions: for this man, when firſt brought on board our ſhip, made many apologies, and begged that he might not be ill-treated for the reſiſtance he made in defending his ſhip; and he was anſwered, that he ſhould be treated rather better than worſe for doing his duty like a brave and honeſt man.

THIS is of ſuch importance to navigation, as to deſerve notice, whether any, or how far ſuch ſigns or ſayings may be obſerved or depended upon from experience, to be of any uſe to ſeamen.

IT muſt be allowed that our world, and ſyſtem of worlds, and the whole creation, as far as we can obſerve, are governed by the ALMIGHTY CREATOR, preſent to all parts, which are moved by *his* general laws, ſo as to be ſubſervient to anſwer all the juſt purpoſes, not only of *his* general, but ſuperintending, ſpecial Providence. Yet we are told, by Revelation, that our ever BLESSED SAVIOUR, Lord of the World, who ſhewed his command of the elements of winds and waves and all nature, as far as we know, and ſaid the wind bloweth where it liſteth, but from whence it came, or where it went we knew not. And accuſed the Jews who would not deſcern the ſigns of the times as foretold reſpecting himſelf, although they attended to the ſigns of the weather by obſervations. "When the ſky was red in the evening, "a ſign of fair weather; but when red and lowering in the "morning, a ſign of foul weather; when ſeeing a cloud riſe out "of the weſt, there cometh a ſhower; and ſo it is. And when "the ſouth wind blows, there will be heat, and it cometh to paſs." And theſe ſigns are continued to be obſerved here to this day. And St. *Paul* in his voyage to *Rome*, in the ſeaſon of the year when ſailing was become dangerous, told what would be the conſequence to the Centurion, who believed the owner and maſter of the ſhip more than St. *Paul*; and when the ſouth wind blew ſoftly, thought they had obtained their purpoſe; but it was attended not only with great hardſhips, and loſs of the ſhip and cargo, but a narrow providential eſcape of their lives, as foretold by St. *Paul*.

FOR theſe reaſons, all that is known from experience either from the barometer, ſigns, or ſayings, that may any way contribute to point out to ſeamen the weather and winds likely to happen, deſerves mentioning at leaſt, to make them more familiar to obſervation, and how they may anſwer.

IN the torrid zone and near the tropicks, it has often been remarked by the learned, that both winds and weather are moſtly periodical at different ſeaſons of the year; and the barometer varies but very little; but in higher latitudes both north and ſouth, like the winds and weather it varies greatly all the year round, as mentioned in the firſt ſix pages. I muſt own, during the many years

obſervations I have made of the barometer, I have often been diſappointed in expecting an eaſterly wind from the glaſs being high; which I find happens with weſterly as well as all other winds, and that a quick riſe as well as the quick fall of the quick-ſilver ſhews changeable and uncertain weather. And that theſe changes of weather and winds no way depend upon the ſituation or phaſes of the moon, or the ſun at the equinoxes, as they are too generally thought to do in this climate. And it has been lately remarked in the philoſophical remarks of the Royal Society, that what are called *influenced times*, have no effect to occaſion changes of wind and weather, and they happen at thoſe times no more than at others; therefore I think thoſe prejudicial notions ought to be exploded, eſpecially thoſe that deter ſhips from going to ſea till the equinoxial gales are over, at which times I can ſay from memory, and an exact Journal kept for 28 years, of winds, their velocity according to Mr. *Smeatons* Tables, and weather and every thing that could affect the tides; in making obſervations on them, that we have as fine weather at the equinoxes as at other times, as by theory, we ought to expect it, becauſe it is then only that the ſun ſhines upon our globe from pole to pole as particularly deſcribed page 123, which ſhould naturally tend to equaliſe the temperature of our air, rather to prevent than to raiſe ſtorms.

FROM what has been ſaid on this ſubject, it is not to be doubted, but that alterations are made in the denſity of the different parts of the atmoſphere, that may cauſe the elements to move ſo as to give the appearances in the ſky, from which theſe ſigns and ſayings had their riſe. "The evening red, and the morning gray, is the ſign "of a fine day. A clear N. W. and a foul S. E. horizon, a "fiſherman's night. A rainbow or weather-gall, at morn, fine "weather all gone. But a rainbow towards night, fair weather in "ſight." It is reckoned a bad ſign when terreſtrial objects, at a diſtance, appear extraordinary clear and near; and when the ſtars appear very numerous and glaring the firſt of the night; and when a great white froſt appears in the morning.

RELATING TO WINDS. "When the ſun ſets clear, an "eaſterly wind you need not fear. When the ſun ſets under a "bank, a weſterly wind you need not want. When the wind "blows cold, it is likely to hold. An eaſterly wind right, com-"monly abates at night." Our frequent long weſterly gales commonly end in varying about to the northward; but when the wind backs

backs (againſt the ſun as it is called) to the ſouthward in the afternoon, it is a ſign of bad weather and the gale continuing. "At coming on of ſqually and blowing weather, when the wind "comes before the rain, lower down the topſails and hoiſt them "again. But when the rain comes before the wind, firſt reef, "and then hand."

BUT to ſail from a port or road-ſtead, or carrying ſail at ſea in ſuſpicious weather, it muſt be left to the commander to form a judgment to act as appearance, ſituation, and circumſtances may require. Yet I cannot help remarking, I have known many great, fatal, and total loſſes by ſailing with ſoutherly winds, with drizzling rain; eſpecially in the winter ſeaſon; which, in this climate for ſeamen, may be reckoned to begin with *October* and end in *March*; when the wind, from being moderate at S. S. E. afterward flies about ſuddenly to the weſtward, and to N. N. W. the oppoſite point of the compaſs, and blows with ſuch violence, as to do great damage, and is very deſtructive to ſhipping, when they are catched unprepared, with a great deal of ſail ſet. Beſides that ſtorm, mentioned pages 5, 6 I have known many others that have been very deſtructive; and one in particular, that deſerves notice, as diſcouragement to that vile cruel practice of preſſing ſeamen for government's ſervice. In the latter part of the foreign war, 1757, in the evening, I ſaw one of his Majeſty's ſnows of war with all ſail ſet crowding away with a large wind at S. S. E. and rainy weather, with about 140 preſſed men on board. That night the wind flew ſuddenly round to the oppoſite point N. N. W. and blew a ſtorm that muſt have overſet and ſunk her, for no remains were ever found, but her barge, that had floated off the booms. So that with a ſoutherly wind and rain, ſhips ſhould be upon their guard, and not be covetous of the weather ſhore, for fear it may ſuddenly prove a dangerous lee one on our coaſts.

ON SHIPS IN DISTRESS.

SUDDEN diſtreſs of ſhips at ſea, has often ſtruck their crews with ſuch panicks as to occaſion them, in many inſtances, to take the worſt, inſtead of the beſt means or methods for their ſafety or relief; their minds being ſo diſcompoſed, at ſuch times. As phyſicians when ſick, are reckoned very unfit to preſcribe

preſcribe for themſelves; therefore every endeavour ſhould be uſed to point out every thing that is thought poſſible to be of any ſervice on theſe melancholy occaſions, as far as circumſtances and ſituation can be deſcribed to happen. For it is but too well known that many people, after ſuffering great hardſhips, have loſt their lives, by two raſhly quitting their ſhips in their boats, when they might have been ſaved if they had ſtaid by their ſhips.

When a ſhip proves weak, and works the oakum out, ſo as to make dangerous leaks between wind and water, it is common to nail ſheet lead upon the ſeams, I can ſay from experience, that lead breaks by the ſhip's working, eſpecially when ſhe hauls under the chains, (as it is called) by the ſtrain of the maſts and ſhrouds making the ſeams open and ſhut as the ſhip rolls. Leather or canvas, nailed on ſlack, with oakum under, will anſwer the purpoſe much better than lead.

ON DANGEROUS LEAKS SUDDENLY BREAKING OUT.

AS ſoon as the pumps are manned and ſet to work, the utmoſt endeavours ſhould be immediately uſed, and all poſſible means tried, to find out and ſtop the leak, before the people become jaded by pumping; which, from experience I can ſay, gives a much better chance for ſafety than a continual pumping, which may prove ineffectual, without endeavouring to ſtop the leak.

On Fothering, to Stop Dangerous Leaks in Ships bottoms; and their Pumps.

I WAS in a ſhip called the PEARL, as mentioned page 24, that had but been three voyages to the Eaſt Indies, that was armed and fitted out at *London*, to cruiſe three months off the Weſtern Iſlands, where in a great ſtorm the ſtep of our foremaſt gave way, by its not being bolted through the timbers, but through the rooms between them, that the bolts worked great leaks in the outſide planks, which great fault of the builder deſerves particular notice, and being ſo low in the bottom the water ruſhed in with great

great violence on both ſides of the kelſon, which made it the more dangerous for the reaſons given page 10, which obliged us to ſet all our pumps to work with the utmoſt exertion, till we got the ſpritſail unbent and ſtitched over with bunches of oakum with ropes to the clues for the fore part and earines, for the after part applied it to fother the leaks, which ſtoped them for a time, till we freed the ſhip from water, and made ſail for Liſbon, and got repaired by heaving keel out, which proves the ſpritſail well adapted for forthering ſhips bottoms by being made ſtrong to bear waſhing and may be eaſily ſpared for this important purpoſe.

ON SHIPS PUMPS.

WE had two chain pumps and two wood ſucking pumps in this ſhip; though the third officer in command, I joined a gang at a chain pump on this important occaſion, to ſhew an example to the people, pumped with a ſwift motion half an hour at a ſpell, by the half hour glaſs, when thoſe at the ſucking pumps could not continue ſtriking them above five minutes at a ſpell, by the pump brakes working breaſt high, which ſoon tires the arms and greatly fatigues the men working them. Therefore chain pumps for ſhips where there is ſufficient room and men to work them, will always have the preference by going round all one way makes a perpetual lift and diſcharge of water in proportion to the ſwiftneſs of the motion they are worked with, which in my opinion excels all the others that I have ſeen.

After all the commendable trials of late that have been made to improve ſhips pumps, yet the lead and wood ſucking pumps are in general uſe even in capital merchant's ſhips, therefore, I ſhall endeavour to relate what has occured to me on this important ſubject.

INSTEAD of working theſe pumps in the common tireſome method with a ſingle brake breaſt high, as abovementioned, I would recommend to make a long ſquare ciſtern of two inch oak plank, 26 inches long, 12 broad and 12 deep, with a partition in the middle, that the two end ſquares may admit two lead pumps to go through their bottoms into the well on each ſide of the kelſon, and their lead ſpouts pointing through the fore ſide of the wood ciſtern, or fixed on the top of two wood pumps with an iron

ſtand

ſtand exactly in the middle, with cheeks and holes that a pump bolt may go through, what I call a double iron brake as a fulcrum or prop that it turns upon, and having a ſlit on each ſide right above the bores of the pumps, with holes for the ſhanks and bolts for the upper boxes, with wood handles at each end, and to be no higher than it can be worked with what I call, underhand pumping, that the men by pulling upwards can pull twice their weight, and by preſſing downward can eaſily preſs their whole weight, ſo that when occaſion requires to work two pumps they make a double ſtroke, that makes two ſtrokes for one in the common way, as may be better perceived on referring to plate the 2d, which deſcribes a pump I got made of two inch fir boards, to pump up the water, whilſt making tunnels for our Wet Docks to waſh the mud out of each other.

THIS pump was made from obſervations on the principles of the preſſure of our air, as mentioned page 3, how boys lifted paving ſtones with their ſmall round ſuckers; to try the experiment, I got my ſhoe-maker to make me two of them, three inches diameter of tanned hide, called butt, that lifted a paving ſtone that weighed fifty ſix pounds, and by ſtilyards the ſame weight, when tried to hearthſtones, which is equal to the weight of ſeven gallons of water. I made the two ſuckers for the vacuum of this pump of the ſame ſort of leather, 12 inches ſquare, nailed to a ſquare frame an inch thick, that exactly fitted and put down upon battons nailed tight, ſix inches from the top of the two ſquares, which made them both air and water tight below. And the main pipe to go down into the water or well, was made of ſtraight flat boards, open four inches ſquare at the bottom, and nine inches by four ſquare at the top, and the partition board going down in the middle when it was fixed faſt, with the plain of the bottom, about 18 inches, left a ſquare opening of about four inches into each ciſtern, on which was fixed a valve on each ſide of the partition, that opened and ſhut as the pump was worked by two ſquare valves fixed in the middle of each leather ſucker, with four ſquare thin iron plates about an inch broad, with holes at each corner for four ſmall branches of the pump rod to go through, with ſcrews and nuts below to faſten the leather and upper valve or clapper, which not only made as long a ſtroke up and down as common ſucking pumps, but by the bending of the leather up and down, added greatly to the vacuum and made two ſtrokes to one common pump, and diſcharged a great deal of water without any friction.

And

And either common lead or wood ſucking pumps may be worked in this manner to great advantage, as before mentioned. A large ſhip that was built here for the *German Eaſt India* company, had four wood ſucking pumps worked upon this principle, to work one, two, three, or all four by this under hand ſtroke.

I cannot help thinking that if what I call double ſucking pumps were well made of oak plank, as above deſcribed, they would ſurpaſs all other ſingle ſucking pumps; for if it is conſidered that ſo ſmall a conical vacuum is made by a three inch ſucker, what may be made by 12 or 15 inch ſquare ſuckers, lifting and diſcharging two ſtrokes for one. And two of theſe pumps may be made to ſtand very well, with the iron brakes of the upright ſtands of the ciſterns, together a midſhips in a ſtraight line fore and aft, abaft the mainmaſt, one ciſtern diſcharging the water forward the other aft, the upper valves opening that way.

The ciſterns ſtanding upon a level, with their upright iron ſtands of equal heigth and length, that long wood handles may be put through the eyes of the brakes on each ſide, to work both pumps together when occaſion requires it. But it requires care that the ciſterns are fixed at the top of the pipes, exactly with that ſmall angle to admit the lower end of them to go down on each ſide of the kelſon, with cleats upon them, to reſt upon the kelſon, to keep them at the proper height from the bottom of the well. The thickneſs of the plank for theſe pipes I recommend the two ſide pieces that are to be four inches broad, from top to bottom, to be two inches thick, but the two fore and after pieces that are to be ſix inches broad at the bottom, to fourteen inches at top, to be from $2\frac{1}{2}$ to three inches thick according to the ſize of the veſſel, and rounded off a little at the corners that iron hoops may drive well upon them, and eſpecially one near the top, with two holes in the middle that a ſmall bolt may paſs through, and the tongues of the ciſterns, four inches broad to go down the middle of the pipes about eighteen inches, when the tops of them are cut to two inches, that the bottom of the ciſterns may be fitted tight even with the top of the pipes, and properly bolted with ſmall metal bolts, nuts, and ſcrews, to keep tthem ſo; I would gladly contribute ſomething handſome to give them a fair trial for ſhips, for it muſt be allowed, that even great geniuſes cannot ſee all that is againſt them in new things till experience decides.

But the performance of the deal pump made and nailed together in a curſory cheap manner, by our common dock carpen-

ters, as mentioned page 248, and repreſented plate the 2d, I was induced by the advice of ſome friends to ſend it up to *London*, to take its chance for the premium that was then offered, by the *Noble Society*, for *Arts*, &c. for the beſt pumps for ſhips, which I did in a waggon, and went up to ſee the trial, at the time appointed, when there appeared only two other on the occaſion, one of them was a round of water buckets to a chain going on a barrel like a chain pump, which was objected to as not fit for ſhips; the other was three common wood ſucking pumps fixed cloſe together in a ſtraight line, the upper boxes were worked by three iron cranks, that were turned round with a long winch the ſame as a chain pump, which three pumps were fixed and tried againſt mine, on board of a ſhip in the *River*, which I muſt own by the ſwiftneſs of the motion of working theſe three pumps united all one way, made them to appear to diſcharge more water than mine, but the difference was not aſertained, no method was made for that purpoſe.

After the trial I waited upon the *Society* for their deciſion, which was, that none of the pumps that appeared, deſerved the premium. I then ſent my pump home by a *Liverpool* trading ſhip.

If they are to be tried on board ſmall veſſels expoſed to a hot ſun, in warm weather, that may cauſe the ciſterns to ſhrink, it may be neceſſary to nail pump leather on the out ſide of what may be called the ſeams of the ciſterns, to keep them air tight, if they come to be in common practice, and worked upon the upper deck, additional power may be eaſily made, of iron bent like a ſwan's neck, to be put occaſionally with a ſmall bolt to the ends of the brakes, with an eye at the upper end, above head, at a proper diſtance, for men to pump with bell ropes, which from experience I can ſay eaſily increaſed the diſcharge of water; this and many other advantages, in my opinion, would attend theſe pumps, above both the common wood and lead ſucking pumps, which diſcharge moſt water in proportion to the tightneſs of the leathers of the upper boxes, and that increaſes the friction in proportion to require more power to work them, and when worked hard for any long time, not only ſoon wears away the leathers of the upper boxes, but the bores of the pumps, lead as well as wood to require ryming, which I think cannot be got done at ſea.

But

BUT if theſe plank pumps were brought into uſe, they might not only be repaired, but made on board ſhips at ſea, if they have the materials, which would be neither expenſive nor cumberſome, and not liable to be choaked as the other ſucking pumps are, by which ſhips have been loſt.

On Seamen Quitting their SHIPS too ſoon, to ſave themſelves in their Boats.

SOME late accidents happened on our neighbouring coaſt, when it was thought the crews of ſome veſſels had left them, and took to their boats to ſave themſelves too ſoon, when it was thought, and in a manner proved, that they had time enough to run for a port or on ſhore, where themſelves and veſſel might have been ſaved, or property from them, for one of them was a brig leaden with coals from *Liverpool*, who boarded a veſſel in their boat that was bound to *Liverpool*, ſaying their veſſel had ſtruck upon a rock or a wreck, that obliged them to quit her.

THE maſter of the veſſel bound here took them on board very reluctantly, ſaying, he thought they were *Liverpool* pilots, or he would not have ſtayed for them, when theſe wrecked people got to *Liverpool*, they complained in a newſpaper, that they had been ill treated and put to ſhamefull ſhort allowance in their paſſage here. This was contradicted, and a report made, another veſſel that had ſeen this veſſel driving a float ſixteen hours after ſhe had been quitted.

THIS occaſioned a juſt remark in one of our newſpapers, that as the water increaſes in the inſide of the veſſel above the leak, the leak decreaſes. And another advantage may be added to it, that the pumps work eaſier and diſcharge more water in proportion as they have leſs height to lift it.

THESE reaſons prove the neceſſity on all ſuch important occaſions, to try not only the utmoſt power of the pumps and all other poſſible means, before they quit their ſhips and take to their boats for ſafety, which often proves fatal; and when the pumps are got fairly ſet to work, it is wrong to depend upon a continual pumping without endeavouring to ſtop the leak, therefore, all the other part of the crew that can be ſpared from pumping, ſhould exert their utmoſt poſſible endeavours to ſtop the leak, and if it

cannot be done within board, and too low under water to do it without board, then to try to fother it with ſome ſtrong ſtayſail ſuch as the main, fore, or fore-top-maſt-ſtay-ſail, or ſprit-ſail ſtitched with oakum, as mentioned page 247, and if there is not ſpare oakum, it may be ſoon made from rope.

WHERE ſo many valuable lives and property are at ſtake, this becomes a ſerious ſubject to give advice upon; yet I think whatever vulgar errors tend to raiſe groundleſs fears on ſuch important occaſions, as much as poſſible ought to be exploded and aboliſhed, and I take that prejudiced notion to be one; that when a ſhip ſinks, ſhe makes ſo great a vortex or whirlpool above her, as to ſwallow up any veſſel that is near her; which from the nature of things in this caſe, I think cannot be true for the following reaſons.

IT is well known, that all ſhip's upper works are lighter and more buyant than their bottom parts, which are more water ſoaked and heavier, and the center of gravity of ſhips, and all that they contain preſſes upon the bottom near the midſhips or main frame, which muſt naturally ſink firſt, as it is the known property of bodies preſſed through fluids, lighter than themſelves to go with the center of gravity firſt, as mentioned page 66, the bottom being of a convex form, the lower part of the deck or decks being of concave form that makes a greater reſiſtance, which makes ſhips ſink gradually upright nearly as they ſwim, without making any vortex or whirlpool, that the boat or boats may be floated off the deck without danger. We had a late inſtance ſince I wrote the above, mentioned in our newſpapers, of a veſſel that was ſunk ſuddenly by another veſſel, when the pilot, whom I examined on the occaſion, cut the boats gripes when ſhe floated off the deck, and the crew got into her and ſaved themſelves, which confirms my opinion to be right.

THIS loſs happened from two ſhips ſtanding upon a wind on different tacks, when both expecting to weather the other, they called to each other to bear away, which they both happened to do at the ſame time, by which they run with the greater force on board each other, that the one, whoſe crew ſaved themſelves in their boat, immediately ſunk.

SUCH

On Ships running on board each other, when ſailing upon a wind on different tacks.

SUCH great deſtruction ſo often made on ſuch valuable lives and property, by ſuch daring obſtinacy on theſe deſperate occaſions, certainly deſerves an attempt at leaſt to prevent as much as poſſible, the fatal loſſes that attend ſo many of our own ſhips.

SUPPOSE a Rule or Law could be made by the Admiralty, that in all doubtful caſes, on theſe dangerous occaſions, that when ſhips on the larboard tack cannot be ſure of weathering the ſhips on the ſtarboard tack, to be obliged to bear away under their ſterns or put about in good time to prevent running on board them, or be made liable to all damages.

ON A SHIP OVERSET, OR LAID ON HER SIDE, AT SEA.

TO recover and get a ſhip upright from this diſmal and dangerous ſituation with the leaſt damage poſſible, is certainly a taſk that deſerves the utmoſt attention.

THE moſt common method is, to cut away the ſhip's maſts, eſpecially the main and mizen maſts, in order to make her ware and bring the wind on the other ſide. But reaſon, as well as experience, has often proved, that this deſperate, and expenſive method, has not anſwered the purpoſe. For the ſhip's hull in that poſition, greatly becalms the maſts, eſpecially the lower maſts and ſails, and prevents the rudder from having ſuch effect upon the water as to make the ſhip ware. In further confirmation of this, I was told by a commander that put this deſperate remedy in practice, that it would not have anſwered the deſign, if it had not happened, from an accident, that ſome of the lower ſtanding rigging on the lee ſide being omitted to be cut, brought the maſts up, and made ſuch ſtop waters on the lee quarter, as, only, cauſed the ſhip to ware.

I HAVE heard of another accident, that recovered a light coal ſhip that had canted her ballaſt at ſea, and overſet ſo low on her ſide, that the bower anchor happened by chance to go from the lee bow, and the cable running out, it took hold in the ground, ſo as to bring the wind a head, which took the ſails aback, and caſt

caſt the ſhip on the other tack, when they ſoon got her trimmed upright again. I was in a light coal ſhip that hove out all her ballaſt at ſea with a ſcant wind to ſail into *Tinmouth* haven, where the pilots as well as ſeamen are the moſt dexterous in the world. In narrow channels theſe men, for the good reaſon of making their ſhips ſure in ſtays always work them with their mainſail, and all the ſail that they can carry ſet. When we came to haul our ſhip by the wind, ſhe laid down on her ſide, ſo as to bring her keel and rudder out of the water, to windward. Our pilot had the preſence of mind to let go the lee anchor, which brought the ſhip round to, with the wind on the other bow that took the ſails aback, as they were ſharp braced up; this immediately brought the ſhip upright again; ſo that we hauled up the courſes, hove up the anchor, and drove to windward into the harbour with the tide; backing and filling under our topſails, without any damage.

On Recovering a SHIP upright, without cutting away the Maſts.

THE above inſtances evidently point out what at leaſt ſhould be tried on theſe dreadful occaſions. If ground is to be reached, by any means, the lee anchor, or anchors, ſhould be immediately let go, if it is poſſible to bring the wind upon that bow that is laid down; then the wind may act upon the maſts and ſails that may be ſet ſo as to bring the ſhip upright again, as above-mentioned; which may be called *club-hauling* a ſhip, to get her from one tack to the other, as mentioned page 87. But in deep water, where anchors can be of no ſervice, I would recommend, that if a tow-line, hawſer, or cable end, can be readily come at; and if the driver boom, hen coops, or any other bulky things can be ſlung by the middle with ropes, and made faſt to it, or even the driver or any other ſail with the clues ſtopped ſo as to make a drag ſail, and veered away with a long ſcope over the lee quarter, to make ſuch great ſtop-waters as to make the ſhip ware, and bring the wind on that quarter that is down, that the ſhip may be brought to on the other tack, and the ſails trimmed, ſo as to get her upright again without cutting away the maſts; which nothing can juſtify but the utmoſt neceſſity, to ſave a ſhip from foundering, becauſe of the great diſtreſs it brings the ſhip under, for want of her maſts; eſpecially her lower maſts; when they may have a

long

long run to their deſigned port, or to a place where they can get this great damage repaired. And many late inſtances have occurred where the maſts have ſtove the veſſels ſides before they could be got clear of.

To make a SHIP ware and ſteer that has loſt her Foremaſt.

TO do this, muſt be of the utmoſt conſequence to a ſhip meeting with this misfortune in a dangerous ſituation. Therefore I venture to give my opinion, that this may be done by the laſt mentioned method, that is, by veering a hawſer or cable end over the lee quarter, but without any ſtop-waters, only the nun buoys, david, or any ſpare ſpars, maſts, or yards, laſhed along it, to buoy it from taking the ground in caſe of coming into ſhoal water, with little wind. This will act with great power, with the helm, to make the ſhip ware and ſteer at pleaſure. And a ſpare yard or boom, may be rigged out abaft the mizen ſhrouds to guy the tow, more or leſs on either quarter, according as the ſhip may have occaſion to ſail, and that makes her gripe more or leſs on the helm, ſo as to require it. It may be eaſily ſhifted from ſide to ſide, to anſwer ſailing upon both tacks, to be guyed the more to leeward in proportion to the ſhip's griping; and when ſailing before the wind to ſecure it over the middle of the ſtern, will prevent the ſhip broaching to againſt the helm both ways. And this would anſwer the purpoſe to make a deep loaded bad ſteering ſhip ſteer better, and prevent her broaching to either way, in ſpite of the beſt helmſmen, on which account they are ſometimes obliged to lie to with a fair wind, as I was told by the commander of a ſhip (who was an expert ſeaman and a good commanding officer) he was often obliged to do.

On Steering a SHIP that has loſt her Rudder.

I WOULD propoſe on this occaſion, a hawſer or cable end, with the nun buoys, ſpare ſpars, maſts, or yards, laſhed along it, to buoy it up, in caſe of coming into ſhoal water; and a boom rigged out on each ſide, cloſe aft athwart the ſtern, with the block

On ſteering a ſhip with a cable's end.

on

on each, at equal diſtances, as far as they can be ſupported from the ſtern; and a block on the rail or gunnel, exactly oppoſite the middle of the barrel, of the wheel, where the ſteering rope, marked with a rope yarn in the middle, is to be taken with three or five turns round the wheel when the midſhip ſpoke, and the mark on the rope, are right up; then the two ends to be paſſed acroſs from the under part of the wheel, and reeved through the blocks on each ſide, and made faſt to the hawſer, or cable that is towed a ſtern exactly a midſhips, and as tight as it can well be to go clear of the ſtern; and then veer and heave freely from ſide to ſide, as the ſteering of the ſhip, with the trimming of the ſails on this occaſion, may require.

THE wheel rope leading under the barrel of the wheel on this occaſion, gives a great advantage; becauſe the wheel is to be hove round the ſame way as when the rudder was in its place; ſo that the ſhip may be cunned ſtarboard, and port, luff and no near, hard a weather, or hard a lee, as occaſion may require; for turning the wheel to put the helm a port, heaves the towing machine up to the block on the ſtarboard quarter, which ſtops water on that ſide, and brings the ſhip's head that way, and acts with the ſame power when hove over to the other ſide, &c. which is the readieſt and beſt *makeſhift* that I know for this purpoſe, when no other help can be had. And ſhould this misfortune happen to a veſſel that has not a ſteering wheel, it requires no great labour or ingenuity to make ſuch a *makeſhift wheel* of a boat s windlaſs, or winch, or other materials that may be found on board; and to fix it abaft the binacle, as the beſt place to anſwer the purpoſe.

On ſteering a ſhip with two ſloops.

BUT when it happens that help and aſſiſtance can be had from other veſſels on this occaſion, I think it neceſſary to remark here, that I have known ſhips that have loſt their rudders on the ſand banks at *Liverpool*, that have been ſteered through narrow dangerous channels, by two pilot ſloops; one with all her ſails ſet, leading and towing in a fair way, with a rope a head of the ſhip, which had but little ſail ſet, and that trimmed, as occaſion required; whilſt the other pilot ſloop, with a rope from each quarter; was towed a ſtern of the ſhip without any, or but occaſional, ſail ready to ſet to ſteer, and ſheer her with the helm on each quarter of the ſhip, as the occaſion required, to confine her to follow the leading ſloop in a fair way, till towed into ſafety.

IN

Captain PECKENHAM's Make Shift RUDDER as here deſcribed, ſuperſedes all other contrivances when it can be made from the materials on board.

IN reading the ſeventh volume of the tranſactions of that moſt noble inſtitution, the Society of Arts; manufactures and commerce. I was highly delighted to ſee made publick in a genteel generous and maſterly manner, with the plate of Captain *Peckenham* in our royal navy, ingenious contrivance of making a ſubſtitute for a ſhip's rudder, from his ſhip's ſtores, and gave it a fair trial. And the value of this important diſcovery is further, and I think ſufficiently confirmed by the report of Captain *Cornwallis* and his officers, who made one on board the CROWN 64 gun ſhip, when they loſt their rudder by the above deſcription, that anſwered ſo well, they thought it ſufficient to ſteer a ſhip to any part of the world. And the monthly Review, which I have taken in many years, for December 1789, page 533, thought the diſcovery of this importance to ſeafaring men, ſhould certainly be publiſhed by itſelf, in a low priced pamphlet, with a plate, and a full deſcription, that it might fall in the way of all Commanders of ſhips, &c.

THESE reaſons, and the very great diſtreſſed ſtate men muſt be in, in a ſhip on that dangerous element without a rudder, induced me to get Mr. *Joſeph Elliott*, who drafted the ſhip HALL, built for the *Jamaica* trade, as mentioned page 38, to go on board her with her commander and others that was pleaſed with the deſign, to examine what ſtores could be found on board to anſwer the purpoſe of making a make-ſhift rudder, in caſe of a misfortune, it ſhould be wanted. Firſt, we found a ſpare main-top-maſt for what may be called the main piece; Second, next to it two pieces from a long pole called the derreck, by which they hoiſt goods in and out, and the ſpritſail yard, which might be eaſily ſpared on ſuch an important occaſion cut in two, and theſe fayed and faſtened to the main piece, and each other with peggs or ſmall fir treenails, with a board at top, and one on each ſide fayed to the top-maſt, and cloſe to theſe boards a woolden round all, another board cut ſo as to give room for the rudder to traverſe freely round the round part of the cap, with two wooldens above and below it round all, and a board nailed on each ſide at the lower part of the rudder, with a woolden above it, as may be obſerved by the plate drawn from a proportional model, made it as big as the HALL's rudder.

BUT it is not uſual for theſe ſhips to carry a ſpare main cap as they do in our navy, though they come very dear when wanted to be made abroad, therefore I think it worth while to carry one, if that ſhould be the caſe, it ſhould be without bolts acroſs the after part, and fairly marked to fit the proper place of the ſternpoſt and run of the ſhip, that the after part of the cap may be cut ſo as to anſwer this important purpoſe, if occaſion ſhould require it, to make what I call the lower rudder band, as one of the anchor-ſtocks, is to make the upper one, and inſtead of uſeing the bolts of the cap, to confine it to its place as in the original. I would recommend to leave room clear of iron, that a groove may be cut to ſuit the ſize of the rope deſigned to go round the cap, with a woolden round that rope, on the ſolid part of the cap to ſtrengthen it, and keeps the rope in its place, that are to be bouſed tight through the hauſe-holes to keep it in its place, as may be ſeen by the plate. And how the ropes lead along the body of a well formed freight ſhip, to confine this lower band firm to its place. The upper band, which is to be made from the greateſt anchor ſtock, in this ſhip it was not found thick enough, but required ſome two inch board in the inſide, to make what I call a round collar juſt fit for the round part of the top-maſt made to traverſe in below the rudder head, all which ſhould be made as perfect and ready as poſſible, that the anchor-ſtock may be trenaled together and fixed ſecure on the deck, where it is to be faſtened a croſs, and if the anchor-ſtock hoops ſhould be too ſmall for the rudder head, it may be woolded above and below the tiller hole to ſtrengthen it.

HAVING proceeded thus far in this model of mine, as well as in the original, as may be ſeen in the excellent book mentioned, that this make-ſhift rudder is fixed ſo far from the ſtern-poſt, that makes it liable to be hurt and damaged by ropes getting into the heel, as it is called, that may haul the lower part away, to prevent which, and to give greater ſecurity to the rudder, I recommended to add what I call a ſole, fixed to the bottom of it, ſuppoſe about two inches thick, with a ſmall ſquare end, to be made at the lower end of the top-maſt, and the other three pieces that make the rudder be tenented through it, and the fore end round to a ſweep of a circle from the center of the lower end of the top-maſt, which is the center of motion of this rudder, and juſt ſo broad as to touch the ſtern-poſt ſlightly, as the rudder traverſes to three points of the compaſs each way. And another rope like that round

round the cap, round the bottom of the rudder with a clove hitch, juſt above the ſole, leading along the ſhip's bottom, tight through the hawſeholes, with the lower part of the ſole, at leaſt ſix inches above the lower part of the keel cloſe to the ſtern-poſt, by which it may be ſecured from damage, and traverſe ſufficiently each way to ſteer the ſhip.

THIS hint of having a rope with a clove hitch put to the bottom of the rudder, in caſe of the lower rudder bands giving way, was recommended to my notice many years ago, by an old ingenious ſhip maſter. And I ſaw an inſtance of one of our *Jamaica* ſhips homeward bound in the *Gulf* of *Florida*, that had all the braſs pointed bands of her rudder broke,* but having an iron one above water held. And by unhanging the rudder and putting a rope with a clove hitch at the bottom of it, and bouſed tight to the lower part of the fore main chain plates on each ſide, which anſwered to ſteer her home very well, and even through a very narrow paſſage which is called our dock guts at *Liverpool*.

I HOPE theſe laſt remarks will be allowed to ſhew the advantage of a ſole and a rope to the bottom of a makeſhift rudder, which I hope to be excuſed recommending to the conſideration of the gentlemen of our incomparable navy, who have it moſt in their power to get a fair trial made of them, and in my opinion it moſt concerns them, as being not only liable to accidents by ſhoals, &c. as was the caſe of Captain *Cornwallis*, but alſo in action in ſingle combat between two ſhips from an enemy, which uſed to be my aim and orders, as I have endeavoured to deſcribe page 229, and repreſented plate 8th, by manœuvering to endeavour to run cloſe under the ſtern to rake the ſhip, and by firing at the rudder to diſable their ſteerage, when that can be done, it gives the greateſt advantage over an enemy, either to take, or leave a ſhip of ſuperior force.

To make further trial of this rudder, I got Mr. *Elliot* to draft and draw a ſhip on the principles as deſcribed page 43, ſhews it plainly, by the curve of the bottom and keel of theſe ſhips at the fore foot, and heel, being ſo much above the level, that they muſt naturally ſit upon the ground, and when afloat, ſwim moſtly where the water preſſes moſt upwards under the midſhip or main frame, that may be called the crown of the elliptical arch of their bottom that

* I think they may be very properly called by the modeſt name of pointed rudder bands, when made of either braſs or iron, to endeavour to aboliſh that moſt vulgar obſcene name pintles, which we ſo ſhamefully give them.

produces ſo many good properties as has been often mentioned. I got a model of a ſhip made with a make-ſhift rudder fixed to it, with the ropes leading along the body of the ſhip to the hauſeholes, and the helm 33 degrees to, or hard aport, as repreſented in the plate, which I hope will contribute to form ideas or notions how make-ſhift rudders may be beſtgot made in diſtreſs and on important occaſions.

BUT merchant's ſhips not carrying caſt iron pig ballaſt, as they do in our navy, to put to the bottom of this rudder as repreſented in the original, it requires conſideration how to do without it. I form a notion if the iron ballaſt was only uſed to ſink the rudder low enough to get it hung, and prevent its riſing after it is hung.

THE greateſt difficulty attending this, appears to me, to get the rudder properly ſunk low enough for this purpoſe, therefore in my opinion, ſome methods ought to be pointed out, though they may not prove equal to what may be ſugeſted to men of common reſources, under ſuch great neceſſity, which is allowed to be the mother of the beſt inventions. Yet I venture to propoſe any ſmall anchor ſlung by a rope, with a clove hitch to its crown, long enough to go up each ſide tight from the bottom to the top of the broad part of the rudder, cloſe to the after part of the main piece, and made tight faſt to confine the anchor cloſe to the ſole, till the rudder head is got entered into its place, then the anchor may be let go from it, and take it on board; or it may be done in the ſame way by a graplin, with a rope made faſt with a clove hitch to its ring, and bags of Ballaſt or any heavy ſtores made faſt to it. And when the rudder head is got to its proper place, the ropes round the cap and the bottom of the rudder may be bouſed tight through the hauſe-holes to the pall bitts, &c. till the anchor-ſtock, formed like a collar, is properly fixed to go round what I call the neck of the rudder, and ſecured athwart in its place that makes the upper band for it.

TO prevent this rudder from riſing, there is not only the ſhoulders as they may be called under the anchor ſtock and cap, but a hole may be bored through the ſtern-poſt an inch or two below the upper broad part of the rudder, with a rope ſtrap through it, to go round the main piece, juſt ſlack enough to let it traverſe as may be ſeen by plate of the rudder.

I MUST own it hurts my feelings, to hear people make difficulties to get uſeful improvements done, when they muſt allow that what one or more men has done, others may do, if they take the ſame pains with equal reſources.

OF

On the Danger of a Lee Shore in a Gale of Wind when the Waves run high.

OF all the dangers at ſea, this is generally allowed to be the greateſt; and moſt people pity ſeamen when in a gale of wind, but none ſo much as thoſe who know from experience the hardſhips they go through in cold weather, long dark winter nights, dangerous ſituations, and near a lee ſhore, eſpecially if it is a rocky one; when the waves run high it is moſt to be dreaded, and the utmoſt endeavours ſhould be uſed to keep from it, becauſe it gives little or no chance of ſaving either the ſhip or the lives of even the beſt of ſwimmers.

I KNEW a melancholy inſtance of this. Two *Algerine* ſhips of war were drove on ſhore with a S. W. gale of wind on the S. W. coaſt of the iſland of *Minorca*, and both ſhips were immediately beat to pieces, and the people, about 800 in number, though the beſt of ſwimmers, were all drowned, or rather killed by the waves daſhing them againſt the rocks, except one man, who, upon a piece of wreck, happened to be thrown ſo high upon the ſhore as to get out of the back ſweep of the waves, which waves killed the others, as might be obſerved by the bruiſed wounds on their bodies; though this rocky ſhore was not ſo ſteep, but I could walk up and down it upon my feet without uſing my hands to ſupport myſelf.

The beſt of ſwimmers ſtand but little chance to ſave themſelves.

To avoid ſuch fatal conſequences as theſe, which often attend ſhips going upon a lee ſhore, every poſſible effort of mind and body ſhould be exerted and tried to preſerve and keep the ſhips off from the ſhore, as being the only chance to ſave the lives of the crews, and the property that is under their charge; by which conduct, only, it is that the hardy and brave officers and ſeamen can be diſtinguiſhed from the ſoft, cowardly lubbers, who give themſelves and the ſhip up in a cowardly manner to go on ſhore, rather than undergo the hardſhip of being obliged to contend with the weather, wind, and waves, which it is certainly their duty to do as long as there is the leaſt appearance of a chance by any means to avoid the dreadful danger; and by which only it is, that they can reaſonably expect Providence to favour them; for it is an allowed maxim in common life, that it is to little purpoſe to endeavour to help thoſe who will not endeavour to help themſelves, and we too often meet with daſtardly lazy ſkulkers at ſea, who, when obliged to be expoſed to the weather, for want of reſolution to rouſe and exert themſelves, become ſo feeble and helpleſs, that they

they are periſhing, and die with cold, when the brave man at the ſame time may be ſweating with ſtruggling manfully in the diſcharge of his duty; as in the late malancholy loſs of the Halſwell Indiaman, in the King's channel. Therefore our marine laws which is much wanted, ſhould allow the officers to force their crew by all poſſible means to their duty when great danger appears, without being afraid of the law, which ſhould only make the defaulters ſuffer according to the damage, or loſs of lives or property, their diſobedience to command may occaſion.

To try to clear the ſhore by carrying ſail, and to box-haul when the ſhip refuſes ſtays.

ON A SHIP BEING NEAR A DANGEROUS LEE SHORE.

TO keep a ſhip off from a dangerous lee ſhore; carrying ſuch ſail as will give her good way through the water upon a wind, as long as ſhe will carry it, is certainly the beſt method to try what can be done; alſo reducing all tophamper, that holds wind, as much as poſſible; for if the ſhore proves ſo deep, or the bottom ſo rocky, as not to afford ſafe anchorage, then ſafety may depend entirely on carrying ſail. And ſuppoſe the ſhip is found embay'd, ſo that ſhe will not clear the ſhore on one tack, and that the waves run ſo high that the ſhip will not ſtay, yet ſhe may be box-hauled, and wared, to loſe very little ground, as mentioned page 79, on box-hauling; and in the inſtance of turning to windward out of *Mount's Bay*, mentioned page 161, with the method we uſed in box-hauling reqreſented in fig. 1, 2, plate the 7th. Therefore deſpair ſhould not take place, but an example of ſpirit and reſolution ſhewn by the officers, after having conſulted together, and the people plainly told what is reſolved upon, and that there is no other chance left to ſave the ſhip and their lives, but to carry all the ſail poſſible, to work the ſhip in the moſt perfect manner; and when ſhe refuſes ſtays, to box-haul her, as before fully deſcribed.

SUPPOSE in this ſituation it is found, that the ſhip will not clear the ſhore on either tack, and after the utmoſt endeavours ſhe is perceived to loſe ground; but as there is no anchorage, there is no other means but to continue turning to the laſt, as the wind may abate, or it may vary or change in your favour, which was the caſe with an intimate friend of mine, who kept turning, though he fell to leeward inſtead of gaining to windward, till they thought it would be the laſt tack they could poſſibly make before they muſt

be

be on ſhore, when providentially the wind changed, and came right off the ſhore all at once, which ſaved both the ſhip and their lives from immediate deſtruction.

To endeavour to ride out a ſtorm on a lee ſhore.

BUT when it happens, that there is clear anchoring ground at a good diſtance from the ſhore, and ſailing proves ineffectual to keep clear of it, then the chief dependance muſt be upon the ground tackle applied to the beſt advantage; and it is in common reckoned a great diſgrace to let a ſhip go on ſhore with any ground tackle left on board that might have been uſefully applied.

SUPPOSE then the ſhip to be properly prepared, and to have let go a catch anchor, and towline bent like a buoy rope to the crown of the ſtream anchor, and the inner end of the ſtream cable bent to the crown of the ſheet or beſt bower anchor with as long ſcope of cable as poſſibly can be contrived, to make the ſhip ride ſafe and eaſy, as is particularly mentioned and recommended in page 94: Where it is known, or found, by ſounding with the lead armed with tallow, that the ground is foul, then no more cable ſhould be veered out than neceſſity requires to bring the ſhip up, to ride with as ſhort a ſcope as poſſible, becauſe the cable is liable to be chafed or cut in two by the rocks; if that happens, there is then the more room a ſtern, and a better chance, for a ſecond or third anchor; trying, to the laſt moment, all poſſible means to keep the ſhip from the ſhore.

To cut away the maſts if neceſſity requires.

WHERE the water is ſo deep that the anchoring ground lies but a little more than a cable's length from the ſhore, then all the anchors ſhould be let go, as fully deſcribed to anſwer this purpoſe, page 98. And when the neceſſity of the ſituation requires it, no heſitation ſhould be made, immediately to cut away all the maſts, except the fore-maſt and the bowſprit; (the fore-top-maſt-ſtay-ſail being made to hoiſt to the fore-maſt head,) which will not only make the ſhip ride with leſs ſtrain upon the anchors and cables, but, if they give way, ſhe will be the better prepared, when neceſſity requires it to be done, as the laſt refuge, to run and lay the ſhip on ſhore to the beſt advantage, in order to ſave all the lives and property that is poſſible to be ſaved, rather then let the ſhip founder, or ſtrike the ground at an anchor, by the tide falling, &c. which affords no chance of ſaving either lives or property. Therefore all poſſible endeavours ſhould be uſed, and attempts made to try every thing that can be ſaid or done, that may prove ſerviceable on this melancholy occaſion.

THIS

THIS often has been and may be the fate of many ſhips in ſpite of the utmoſt powers of men; and when a ſhip's ſituation is ſuch, that to all appearance it cannot be avoided, then the utmoſt endeavours ſhould be uſed, and no poſſible means left untried, that may any way contribute to be ſervicable on this laſt and moſt important occaſion, to ſave all the lives and property that is poſſible; whether ſucceſsful or not, it deſerves the higheſt encomiums, as being the greateſt proof of true courage and good conduct.

BUT ſhips ſituations, circumſtances, times, and places, are ſo different and various, that to give advice on this dreadful occaſion is difficult: yet, at all hazard, every thing likely ſhould be ſaid and done. For it is well known, from reaſon as well as experience, that to let a ſhip drive at random broadſide to, where the tide is flowing upon a moderate riſing ſhore, with her main-maſt ſtanding, when ſhe comes to ſtrike hard upon the ground, by the waves running high, ſhe will ſoon overſet on her broadſide, and cauſe the hatches to blow off; then the waves will break in at the hatchways and compreſs the confined air within her, ſo as to add the power of blowing to that of beating the ſhip to pieces, which muſt afford little or no chance to ſave lives, or property which is liable to be deſtroyed or ſpoiled by the waves, and therefore likely to occaſion a fatal and total loſs.

THESE reaſons, I hope, will be thought ſufficient to prove the neceſſity of endeavouring to point out better management; for it ſhould be conſidered, that a ſhip going on ſhore at theſe times in a tide's way, upon a flood, will continue beating as long as the tide flows, and until it falls; and if ſhe lies broadſide to the waves, they will have about three times more power on her than when laid end on to them; and the mainmaſt, ſtanding in the main body of the ſhip, occaſions her to overſet at ſuch times: and it is well known, that a ſhip will bear but little beating upon her broadſide in proportion to what ſhe will bear upon her bottom.

The beſt management on a gradual riſing ſhore in a tide way.

THEREFORE the beſt conduct, on this occaſion, is to uſe all poſſible means to keep the ſhip from going on ſuch a ſhore as this till after high water; and the main and mizen-maſt being firſt cut away, then to run right before the wind and waves, with all the head way and ſails that poſſibly can be ſet, end on upon the ſhore, to make the ſhip free herſelf the more, and to run the higher and faſter upon the ground, ſo that by the advantage of the tide falling, ſhe may ſoon be ſet ſo faſt as to be out of the power of the

waves

waves to hurt her much. By this management, in my opinion, not only all the lives, but the ſhip and cargo may be often ſaved, which would be all loſt by letting her go at random with a flowing tide.

NOTWITHSTANDING a ſhip may be thus ſucceſsfully run and ſet faſt upon a ſhore, with little damage to her hull, and no danger to be apprehended till towards high water the next tide, if the ſtorm continues ſo long; yet people too often let their fears overcome their reaſon, and being in too great a hurry to quit the ſhip, and attempting to get on ſhore through the waves, may often loſe their lives and the boats they go in; when if they would conſider and ſtay with patience till the tide falls low enough, they may get ſafe on ſhore with little or no riſk; and where the tide riſes and falls a great deal, the ſhip may come quite a-dry at low water; which time muſt be allowed to be the ſafeſt and beſt to land, whether the ſhip dries or not; for the water is then ſmootheſt and there will be the leſs way to go in it: therefore, if poſſible, the people ſhould be reſtrained from quitting the ſhip with the boats, till towards low water; and when got ſafe on ſhore, it may be abſolutely neceſſary, to preſerve the boats, to haul them out of harm's way, above high water mark, out of the reach of the waves, where they may be turned bottom up, and made a place of ſhelter when there is no other to be had, and be ſtill ready, to go to the ſhip, if the weather permits, and occaſion requires.

To wait the beſt time to quit the ſhip.

ON this, as well as on many other uſeful occaſions, the beſt and eaſieſt method to haul a boat up and down over a long gradual riſing ſand, or ſtrand, deſerves notice. Inſtead of the common method of laying oars acroſs, and hauling the boat upright over them upon the keel, end on, I would recommend, from experience, firſt to lay the boat broadſide to the ſhore, the way ſhe is deſigned to be hauled, and heeling her off, ſo as to put the blade of a ſingle oar under her keel a-midſhips, and lay all the other oars length way, the blade of one to the loom of the other; then the boats crew divided equally on each ſide of the oars, take hold of the gunnel, heel her bilge upon the firſt oar, keeping her upon a poiſe, and run her along with great eaſe, the whole length of the oars at a time; and if a little ſea-tang can be got to put under the bilge of the boat, it will make her ſlide with more eaſe along the oars, which are to be ſhifted forward when the boat is on the loom of the laſt oar, &c.

To preſerve the boats and the beſt method to haul them over a long ſand or ſtrand.

On hard rocks, ſteep to under water, and high upright cliffs above water.

DIFFERENT ſhores require different management on this deſperate occaſion. And where the ſhore is nothing but hard rocks, ſteep to, under water, and high lofty upright cliffs above water, which are impoſſible to be climbed up; in this ſituation, no ſail can be of any ſervice, therefore all the maſts ſhould be cut away, and ſafety then depends entirely on the ground tackle being uſed to the beſt advantage; and if the ſhip drives till ſhe comes near the high cliffs, it is well known they make both the wind and waves to rebound from them to ſome diſtance, where, if the ground tackle happens to hold any thing, it may give the ſhip a chance to ride there; and as this is the only chance againſt a fatal and total loſs, it ought to be tried in the beſt manner it is poſſible.

On a gentle riſing ſhore, when the waves are not ſo violent.

SHIPS drove broadſide on a gradual riſing ſhore, when the waves are not ſo violent as to bulge them directly, may find great advantage from lightening them abaft, or trimming them ſo much by the head with their goods, or ballaſt, as to make them ſwing end on, with their heads to the ſea, which is certainly the beſt poſition a ſhip can be laid in, not only to bear the force of the waves with the leaſt damage while the gale laſts, but to heave the ſhip off after the gale ceaſes. When water is wanting for this or other porpoſes of great neceſſity, in proportion as a ſhip can be made to heel, it leſſens her draft of water.

On Saving Lives from a SHIP loſt on a LEE-SHORE.

TO be any way aiding and aſſiſting to ſave the lives of people from ſhips that are forced, or loſt, upon a lee ſhore, muſt be allowed to be one of the higheſt acts of humanity and charity that mankind is capable of performing, and deſerves the higheſt praiſe and the moſt grateful acknowledgements that are poſſible to be given. And to offer to deſtroy or diſtreſs the diſtreſſed in this lamentable ſituation, muſt be deemed the higheſt act of villainy, and deſerves the ſevereſt puniſhments which our laws very juſtly inflict.

TIME circumſtances, and ſituations, are ſo various, that it is very difficult to write what may be to the purpoſe on this moſt melancholy occaſion. And another defect I muſt own, (for which I have great reaſon to be thankful to Providence) never having been ſhip-wrecked, I cannot pretend to write from experience; yet,

yet, under all theſe diſadvantages, as I think it is abſolutely neceſſary that it ſhould be attempted by ſome body, I venture (ſailor like) to do my beſt.

SUCCESS in many ſituations may depend greatly on aſſiſtance from people on ſhore; but as that is uncertain, and cannot be expected in the night, or in deſert places, therefore the utmoſt endeavours ſhould be uſed to contrive and try what can be done on board a ſhip, that may be ſuppoſed to be bulged or broke, ſo much upon the ground as to be paſt all recovery. And when a current or tide runs ſo ſtrong between the wreck and the ſhore, as prevents booms, maſts, or yards, &c. with ropes made faſt to them, from being veered on ſhore, and even the patent cork lines that ſhips have on board, contrived for the purpoſe of veering to people on the ſhore, in order to get ropes paſſed to make hauling lines, or travellers, from the ſhip to the ſhore, as neceſſity required, to ſave the people, have been rendered ineffectual by the current or tide.

I was told by an officer of the LITCHFIELD, (a 50 gun ſhip loſt on the coaſt of South *Barbary*,) that all their endeavours proved ineffectual to get a rope on ſhore, from the ſtrength of the current. And an acquaintance of mine, caſt on a lee ſhore in our neighbourhood, could not get a line on ſhore, where there were many people ready, endeavouring to help them; the recoil of the waves always waſhed the buoys off again, out of the power or poſſibility of the people on ſhore to reach them with ſafety.

THEREFORE, in order to endeavour to mend the defects of theſe contrivances, for this moſt noble purpoſe, I take the liberty to propoſe to thoſe in power, to have experiments tried on board his Majeſty's ſhips lying in ordinary. Firſt, whether it is not practicable to make a *flying ſtorm kite* on board a ſhip wrecked upon a lee ſhore, that may, by the force of the wind be made to carry an iron-creeper or grappling, made faſt to the end of a rope, from the wreck to the ſhore; by which, acceſs may be got to the ſhore, when prevented by the tide, current, or returning waves; as above mentioned.

Experiments recommended to be tried for this noble purpoſe.

I would propoſe theſe kites to be ſuch as may be eaſily and readily made on board any wrecked veſſel, and to conſiſt only of two ſlips of thin deal board, about three inches broad, the long piece to be 7, 8 or 9 feet long according to the weight of the creeper, grappling, or boat's anchor, and the rope deſigned to be ſent on ſhore; and the croſs piece about half the length of the

long piece, to be nailed about a third from the top that forms the kite, to be ſpanned with logg or lead line from the four ends of the boards, and covered with a piece of light ſail, and ſlung from the four ends of the boards, and ſtrengthened with a ſpan in the middle to the lower part of the croſs board, where the kite rope is to be ſeized, and at the lower end of the kite, 2, 3 or 4 fathoms, from the end of the kite rope that is to be bent to a grappling, creeper, or boat's anchor, to anſwer the purpoſe of the kite's tail, to balance it's flying the ſame as boys common kites are with twine in moderate winds, to be flown from the wreck above the ſhore. Then it may be aſked how the kite may be made to fall ſo low that the anchor, &c. may take hold of the ground, if neceſſity requires this immediately to be done, and have ſtill a ſcope of the kite rope on board, the experiment might be tried by letting kite rope run looſe for a time, the weight of the rope and anchor, &c. if they would not make it immediately fall upon the ground.

BUT if this cannot be done, what is called meſſengers may be made and ſent up by the force of the wind, the firſt I would propoſe to be made of three boards eight or nine feet long nailed together, to form a triangle and covered with a piece of ſail, and a hole made through the wood in the upper corner for the kite rope to be reeved through, and a line according to the height of the kite rope above the ground to be made faſt to the middle of the lower board, that if any inhabitants appear they may haul it down, and fix the anchor faſt in the ground that a traveller may be made by it. And if the downhaul line be long enough for the end to be kept on board, a larger rope may be hauled on ſhore by the inhabitants, and fixed ſo, that a ſtrong traveller may be made that not only lives but property may be ſaved by it.

SINCE publiſhing theſe hints, I ſaw an account of a letter being ſent on ſhore from one of our ſhips of war, (when they durſt not venture with their boats to make their wants known) by putting a letter in a bottle tied to a kite's tail as here mentioned. The end of the kite's tail made faſt to a wooden buoy that floated on the ſea, that kept the kite in ſuch an elevation, that the bottle could be readily received by the people on ſhore. And it may be eaſily perceived how an anſwer might be returned by the ſame means, if required, by hauling the kite back to the ſhip.

THE next experiment, for this purpoſe, I would propoſe to be tried, is, how far it is practicable to ſhoot a grappling with a rope bent

bent to it, laſhed along the outer end of a handſpike, &c. made round juſt to fit the bore of a great gun, and long enough to reach from the ring of the grappling cloſe to the wad next the powder, with the gun elevated to its higheſt range, in order to get a rope from the wreck to the ſhore. And all the ropes that may be neceſſary on this occaſion, ſhould be with long ſplices to anſwer this purpoſe beſt.

LET it now be ſuppoſed, that a rope is got from the wreck to the ſhore, and ſecured as well as poſſible till ſome body can be got on ſhore by it to ſecure it better. To do this, I would propoſe to ſling, in a light but ſecure manner, to two ſingle blocks, one at each end, ſome of theſe things that can be eaſieſt come at on board the wreck, ſuch as a cot, a ſcuttle caſk, a cheſt without its lid, a main hatch, or a cabin table the lower ſide up, &c. that a man or two, as the ſituation and circumſtances may admit and require, may be ſecured in or upon this machine; then reeve the ſhore rope through the machine blocks, and to that part of the wreck where it may lead and be hauled tight to the greateſt advantage, to ſupport the machine, running or travelling upon it from the wreck to the ſhore, in the ſureſt and beſt manner poſſible; and if the wreck has any lower maſts ſtanding, the ſhore rope leading over the maſt head, would moſt likely anſwer the purpoſe beſt, and the top afford a convenient place to get fixed in, and go from, with the machine to the ſhore. And a hogſhead, puncheon, or a butt, in my opinion, might be ſkuttled on each ſide of the bung, for a machine; ſo that two men might ſtand facing each other, to great advantage, to haul it on ſhore, if the ſituation required it; or any other thing that the ſhore rope and tackle may be thought ſtrong enough to bear.

BUT the facility or difficulty attending the execution of theſe propoſals, are in proportion to the diſtance and height of the ſhore from the wreck; if the ſhore is low, and near the wreck, the ſhore rope may be made to lead the machine upon it with an eaſy deſcent, from the wreck to the ſhore, with a man or two in it, without much ſtrain either to the rope or grappling on ſhore. When this is likely to be the caſe, a line ſhould be made faſt to the machine, to haul it to the wreck again; by which means it may happen that a ſhipwrecked crew may ſoon get on ſhore, with eaſe and ſafety.

BUT when the ſhore happens to be at a great diſtance, and much higher than any part of the wreck, this muſt naturally increaſe the ſtrain on the ſhore rope and grappling, &c. that holds

it,

it, and to the man or men who are to haul the machine on ſhore by it. Therefore, to endeavour to eaſe this ſtrain, I would propoſe, as it appears to me practicable, to contrive and fix a ſmall ſail to the machine, ſuch as a hammock or two that has holes ready wrought at each end, a tarpawling, or a piece of a ſail cut for the purpoſe, that may be ſoon bent and ſtitched with a ſail needle and twine to light pieces of wood; one to be as a yard, ſtopped to the head of an upright piece or two, that may be ſtopped or laſhed to the after end of the machine as maſts, ſeven or eight foot high above it, next the ſhip, and the foot hauled down to the fore part of the machine next the ſhore; this ſail ſet to ſtand in this ſlanting direction upon the machine that is to run right before the wind in a ſtorm, will certainly help greatly to liſt and leſſen the ſtrain of the machine upon the ſhore rope, and force it forward with great power towards the ſhore. And if, by any ſuch means as theſe, a man or two can be got on ſhore ſafe, they may ſecure things to the beſt advantage; and by hauling lines, may be the means of getting all the reſt of the people on ſhore, beforethe wreck is beat to pieces by the waves.

BUT it may be ſaid, that the firſt adventurers in theſe machines run a great riſk; which muſt be allowed; but deſperate ſituations require deſperate proceeding; when delays are dangerous, if this is the only method that appears to give chance to ſave life, the the firſt adventures ſtand the beſt chance if they ſucceed in getting on ſhore ſafe, when every minute the wreck may be liable to be beat to pieces, and all left on board moſt likely to ſuffer.

Now let it be ſuppoſed that their is neither tide nor current to hinder any floating things being drove on ſhore from the wreck, by the force of the wind and waves. Then a towline, or other ſuitable rope, with a hauling line, &c. may be made faſt about the middle of a ſpar, maſt, or yard, &c. and veered away on ſhore, as far as it will go; and if it happens to be an uneven rocky ſhore, it may chance to fix itſelf faſt among the rocks, by which I have heard a ſhip's crew got on ſhore, when they had almoſt given themſelves up for loſt. But if it is a ſandy or gravelly ſhore, then no ſuch chance can be expected; it will then require ſome people on ſhore to haul it up, and put it under the ſand or gravel, its broadſide to the wreck, (as deſcribed page 107, on mooring ſhips) to make it bear the ſtrain that is neceſſary for the rope to be tight enough for the machine, as abovementioned, to travel upon from the wreck to the ſhore.

Now

Now let it be ſuppoſed, that a ſet of good people appear upon the ſhore, for the noble purpoſe of doing all in their power, to ſave the lives of thoſe diſtreſſed people on board wrecks. To ſucceed therein, it is abſolutely neceſſary that the people on ſhore ſhould be made to underſtand ſomething of the deſigned methods of proceeding. Therefore the beſt and moſt approved methods that experiments may produce, ſhould be recommended and deſcribed in prints, for the purpoſe of being diſtributed amongſt our ſhips, and amongſt the inhabitants along our ſea coaſts, to be made as public as poſſible, and rewards of a guinea, certain, ſhould be allowed to the poor people on ſhore, for every human life ſaved by them, from wrecks, and veſſels forced on ſhore. *Liverpool* leads the way for this noble purpoſe; and in proportion to the danger and trouble, they are to be rewarded with more than a guinea, as it is thought by a committee that they deſerve; which encouragement may likewiſe be the means of ſaving their own lives from the juſt laws of our country, by preventing their cruelty, for the ſake of plunder, on theſe occaſions; and might encourage them to obſerve and join heartily in whatever methods they perceive the people on board the wreck take to ſave themſelves, and to help them in it, by ſecuring the ſhore rope, or uſing the hauling line to haul the machine on ſhore, if it is high above the wreck, or made faſt to a raft, as the circumſtances and ſituation may require. And if ever the time come to have ſuch prints on board ſhips for this purpoſe; ſuch as that patent Print invented by Mr. *John Winn*, of *Great Yarmouth*. To which I think might be added, that inſtead of anchors, which are not always to be had, any wood, or bulky matter, put under the ſand, with their broadeſt parts towards the wreck, will even hold more than anchors on ſuch occaſions. And I could wiſh that ſuch another plate for a wreck was repreſented, where there is neither ſand nor ſtrand to come adry, and only high, ſteep, inacceſſable rocky cliffs, with ſome ſuch methods as I have endeavoured to deſcribe, page 268. And they might by ſome means be put into a bottle, and ſent on ſhore to inſtruct the inhabitants, if any appeared. One of them ſhould be rolled up and put into a bottle, and ſent from the wreck to the people on ſhore, by ſome ſuch method as abovementioned; or by throwing the bottle, well cork'd, in the ſea, to make them underſtand the deſigned method of proceeding: which may be the means of ſaving many valuable lives, as well paſſengers as ſhips crews, whoſe lives are undoubtedly of much more importance than

Certain rewards for poor people ſaving lives recommended.

than ſhips. Ships may be renewed, but they are of little purpoſe without good crews to navigate them; and the difficulty we now meet with, in manning both ſhips of war and merchant's ſhips, ſhould teach us to uſe every poſſible method to preſerve the lives of our brave ſeamen, thoſe ſupporters of our glory, power, wealth, and conſequence as a nation;---they dare the raging tempeſt cheerfully, and the dreadful ſlaughter from thundering cannon does not diſmay them; therefore, how pleaſing muſt the thought and reflection be, to all who contribute to help and ſave them.

On preſerving Boats from Foundering when Ships Founder.

IN January, 1786, in the *Liverpool* news-papers, I met with what I think an excellent method for this purpoſe, related as an experienced fact, which I thought, well deſerved to be made further public, to recommend the beneficial practice to ſave lives on ſuch dreadful occaſions. It was related as follows.

THE BASIL, in her paſſage from the *Weſt-Indies*, took up ten men in a ſmall boat, 12 feet long, which was preſerved from foundering, after their veſſel had foundered, by having a rope faſt to a log of wood, as they called it, and tied to the boat's bow, which kept her to drive end on with the head to the waves, and broke their violence ſo much as to preſerve her from filling with water, when one half of them was obliged to lie down in the bottom of the boat, to prevent her being top-heavy.

I READ this account with great pleaſure, but could form no idea, how a common log of wood could anſwer this good purpoſe. I therefore went to be better informed of particulars from the Captain and Chief mate of the BASIL, from whom I learned, that thoſe people belonging to a ſchooner, bound from *Bermudas* to the *Weſt-Indies*; that it was after a hard gale of wind when they met with the boat, and took them on board. And that the log of wood, as it was called, they drove by, was their fore ſquare ſail yard, ſpanned with a rope to each yard arm, and a rope about 10 or 12 fathoms bent to the middle of the ſpan to the boats bow, to drive by as above related.

I ASKED them if the people had told them what diſtance they drove from the drift boom (which I ſhall now call it) in the time of the ſtorm: they ſaid, no. And whether this method was their own

own invention, according to the proverb that neceſſity is the mother of invention, or from a practice known before. The Captain ſaid, the Mate of the ſchooner told him they had been ſaved ſo, in a boat once before, by driving to leeward of a maſt (as he called it) in a hurricane in the *Weſt-Indies*, which I heard further confirmed by inquiry amongſt our ſeafaring gentlemen who had been factors in the *Weſt-Indies*. I met with one that ſaid he had heard of ſuch a practice in hurricane times. It therefore deſerves our endeavours to account for it from natural cauſes and effects.

IN affairs of this kind we muſt be allowed to compare ſmall things with great; and from the practice of all common water carriers in open veſſels, it may be obſerved how experience has taught them always to have a diſh, or ſome piece of wood ſwiming on the water, to prevent its waving over the top of the veſſel. And it is well known to all experienced ſeafaring men, with what eaſe and ſafety an open boat will riſe and fall in high ſolid waves, and eſpecially when kept end on to them, in compariſon to what they will do in broken waves, where they are very liable to be brought broad ſide to them, and when the broken water naturally ſoon fills them.

THEREFORE the cauſe which makes waves to break, is a material point in treating this ſubject philoſophically. And it may be obſerved, that waves never break till their tops are forced forward by their great velocity beyond the perpendicular of their baſe; then that ſolid water falls down forward, and incloſes and compreſſes a quantity of air, which by the power of its elaſticity blows this fore part of the waves to pieces, forwards and upwards, in an oblique direction, and makes it appear like froth. They then have no buoyant power to lift a boat; but when they are high, they fill and ſink her. And they break more in ſhoal water than in deep, in proportion as their bottoms or baſes are more obſtructed in their velocity by the ground than their tops; hence in very ſhoal water they are continually breaking, ſo that they make nothing but what is called broken water, by which ſhoals may be ſeen and known at a great diſtance in clear weather.

IF we endeavour to account for the wonderful effect of ſo ſmall and ſimple a machine to preſerve ſuch a ſmall boat, deeply laden as ſhe muſt be with ten men, from being filled with water in ſuch a ſtorm; in my opinion, it is owing to the boat driving end on by the drift boom, that keeps it always ſwimming on the ſurface broadſide to the wind, and the waves that are running towards it

within the length of the drift boom, muſt certainly obſtruct the velocity of the upper part of theſe waves, ſo as to leſſon their increaſe in height, and prevent the top from running beyond the perpendicular of the baſe or bottom of theſe waves, that occaſions their breaking, as has been deſcribed, but ſpend themſelves without breaking. Theſe reaſons, I hope, will be thought ſufficient to recommend this method to be tried and brought into practice on ſuch dreadful occaſions. And I cannot help thinking that the ſame method ſhould be tried, when under the dreadful neceſſity of ſaving lives by boats landing on a lee ſhore in a ſtorm where broken waves run high. The only difference I would recommend in the management, is to proceed with the boats ſtern to the drift boom, and her head to the ſhore, to be ready to row and ſteer for the beſt apparent landing place; and if it is a long flat ſhore, as ſoon as the boat ſtrikes the ground, cut or ſlip the drift boom rope, that it may not haul the boat off the ſhore again by the back ſweep of the waves.

To make a drift boom, no doubt but any maſt, boom, or yard, will anſwer the purpoſe; but of courſe the larger and longer, the better. I could not learn from theſe people any rule for ſlinging it, &c. But what I would recommend is, the bight of the ſpan, after being well made faſt to each end, to be full twice as long as the boom, and the boat rope to be bent exactly in the middle of the bight of the ſpan, which need not, in my opinion, be above ten fathom long; for I think the boat's driving either by the head or ſtern, ſhould be within three or four fathom to the bend of the ſpan, to find ſhelter from the drift boom in a ſtorm. And when this misfortune happens far from land, and the ſtorm ceaſes, in moderate weather the drift boom may be towed end on to the boat's ſtern, that they may either row or ſail towards land; as, by the account, this ſmall boat had two oars, for maſts, and two blankets ſet upon them for ſails, and was ſteering for *Bermudas*, when they were fortunately taken up and carried there; what little bread and water they had, being almoſt expended.

To prevent Thirſt on theſe Miſerable Occaſions in a Warm Climate.

AND as the want of freſh water often adds to the miſery and deſtruction of people in theſe dreadful ſituations, I here relate a ſimple method to prevent thirſt, as taken by Mr. *John Kennedy*,

Kennedy, a commander in the *African* trade, from whom I had it, who was put to the neceſſity with his ſhips crew, to run along way towards the *Bay* of *Honduras*, to ſave their lives, without freſh water. The method they took by his recommendation was this; having ſome blankets in the boat, in the day time when the ſun was hot, they, by turns dipped the blankets in the ſalt water, and wrapped them cloſe to the trunk of their naked bodies, which have ſuch wonderful powers and properties given them, as by abſorption, or ſuction as ſeamen commonly call it, to attract or ſuck in through the pores of the ſkin, the finer particles of the freſh water from the ſalt that is mixed with it, which he reckoned not only ſaved them from thirſt but from death. And at his return home, he gave a report in perſon to the moſt famous Phyſicians in *London*, who received him with polite attention, and thanks for this new diſcovery, by which he and his people where ſaved. But it may be doubted whether this method could be uſed in temperate or cold climates, and whether in very cold weather the remedy might not be worſe than the diſeaſe: but then in cold weather thirſt is not ſo prevalent as in warm climates.

Dr. *Franklin*, in his 52d letter on philoſophical ſubjects, from the ſame reaſoning, imagines, (and he ſays it will probably be conſidered as a whim of his,) "that the thirſt of a crew at ſea, in want of freſh water, may be relieved, either by their ſitting an hour or two in a day, in bathing tubs made of their empty water caſks, filled with ſea water; or by keeping their clothes wet with it."---If I recollect right, this method was practiſed by Commodore *Byrom*, with ſucceſs, and is related in his Narrative.

ON THE HEALTH AND DISEASES OF SEAMEN.

INTEREST as well as humanity, demands all that can be ſaid to any purpoſe on this important ſubject, becauſe it muſt be always allowed, that ſucceſs depends on the health and ſpirits of the ſhip's crew, in their different ſtations, to do the duty with dexterity and bravery, which difficult, dangerous and trying occaſions often require: and it is certainly much better to endeavour to prevent than to cure thoſe diſeaſes ſeamen are moſt commonly ſubject to, from the hardſhips they are obliged to go through in doing their duty with reputation, the effects of which I have learned from

my own feelings, and obſervations on others who have ſuffered by them. This induces me to endeavour to relate, what I have ſeen and experienced myſelf, and to make a few remarks which I think may be of ſome ſervice to my brother ſeamen.

ON this occaſion I do not pretend to write as a doctor, but as a ſailor who has tried how far he was capable by uſe to accuſtom himſelf to hardſhips, which it is commonly expected the hardy ſeaman ſhould be able to bear without loſing his health.

ON WEARING AND SLEEPING IN WET CLOATHS.

I TRIED the experiment of wearing and ſleeping in wet cloaths, when I had dry ones to put on, till I got the cramp by it. I have been a ſufferer by refuſing to put on ſufficient cloaths to guard againſt the effect of a dry cold wind, even in the fine climate in the *Mediterranean*, off the ſouth of *France*, where our weak and ſickly gentry go to recover their health. I was mate of a bomb's tender in *Hieres Bay*, with our great fleet under *Matthews* and *Leſtock*. In the fall of the year a freſh northerly wind blew right off the ſhore, which I felt ſo piercing cold, as to demand putting on another jacket, and to wear two inſtead of one, which I thought it was too early in the ſeaſon to be obliged to ſubmit to. In conſequence of refuſing to comply with this demand of nature, I was ſoon taken with a griping which ended in a violent fever, from which I very narrowly eſcaped with life.

ON THE BLOODY FLUX.

TWICE I have had this diſeaſe; once by being long wet in a deep loaded ſhip in a winter's paſſage from *Jamaica*: The other time by ſleeping on the bare ground, in that warm country the *Bay* of *Honduras*. The quick and eaſy cure I met with in the height of this diſeaſe, I think deſerves mentioning. When I was obliged to have a painful motion every quarter of an hour, and durſt not expoſe myſelf to the leaſt air of wind, I was told of ſhips that were coming into the bay, without firſt ſending in their boats, as uſual, to make known who they were; and being then by turn

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(as was cuſtomary) deputed commodore, I gave orders to fire at them; which they not paying regard to, but continuing to run in, it alarmed and rouſed me to action, and I was four hours afterwards without going to ſtool; and then I had a favourable one, and ſoon got well. So that we may ſometimes be rouſed into action greatly to our advantage.

ON THE SEA SCURVY.

I HAD the experience of this deſtructive diſeaſe for about three months in a paſſage to the *Eaſt-Indies*, in the year 1738-9, when for the advantage of private trade, as I was told afterwards by the ſhip's huſband,) we ſailed with ten tuns of beer and freſh water ſhort of the uſual quantity allowed to be carried, and yet the ſhip ſo deep laden, that in our paſſage to the Downs, ſhe ſhipped ſo much water that filled her deep waiſt, and frightened and occaſioned the ſeamen to proteſt and refuſe to proceed on the voyage without the ſhip's being lightened. But a ſhip of war in the Downs ſettled the affair by taking, and changing for other men, ſome of the principal promoters of the proteſt, which made the others comply to proceed on the voyage.

WE were ſeven months on our outward bound paſſage, without touching any where for refreſhment, till we got to *Pullicat*, a Dutch factory near *Madraſs*, where we were bound, and were five months at ſhore allowance of water, which, with the very ſalt beef that had remained from the laſt voyage (conſequently above three years ſalted) being the firſt uſed in this, was the occaſion of the ſcurvy coming the ſooner, and being more ſevere, amongſt us.

THIS being my firſt voyage in this trade, and only a forecaſtleman; as I was adviſed, I laid in a little ſea ſtore, of what was thought neceſſary, nouriſhing things for theſe long paſſages; but I happened to meet with a meſſmate of a ſaving and trading turn, who in his laſt voyage to *China*, had made great profits from a ſmall adventure; and as we were bound from *Madraſs* to *China*, he adviſed me to ſell my little ſtore of brandy, ſugar, ſage for tea, &c. when they became a good price, and join him in partnerſhip in adventures; which I did; thinking my youth, health, and ſtrength of conſtitution, would enable me to live upon the ſhip's ſalt proviſion as I had done in common merchant's ſhips before: but

I found myſelf much miſtaken; for after being about four months in our paſſage from the Downs, after eating a hearty breakfaſt of ſalt beef, I found myſelf taken with a pain under my left breaſt, where I had formerly received a dangerous blow. From this time the ſea ſcurvy increaſed upon me, as it had done upon many others, a good while before me; and I obſerved, that they ſoon took to their hammocks below, and became black in their armpits and hams, their limbs being ſtiff and ſwelled, with read ſpecks, and ſoon died; I therefore kept exerciſing in my duty, and went aloft as long as poſſible, and till forbidden by the officers, who found it troubleſome to get me down with ſafety, as I frequently loſt the uſe of my hands and feet, for a time, in the ſame manner as I had done when I received the above mentioned blow. I then endeavoured to be uſeful below, and ſteered the ſhip, till I could not climb by the notches of the ſtantion at the fore hatchway, upon deck; which I told the Captain; who then ordered the carpenter to make a ladder, that anſwered the purpoſe for the ſick who were able to get upon deck for the benefit of exerciſe, and pure air; as that below being much tainted by ſo many ſick. I thus ſtruggled with the diſeaſe, 'till it increaſed ſo that my armpits and hams grew black, but did not ſwell, and I pined away to a weak, helpleſs condition; with my teeth all looſe, and my upper and lower gums ſwelled and clotted together like a jelly, and they bled to that degree, that I was obliged to lie with my mouth hanging over the ſide of my hammock, to let the blood run out, and to keep it from clotting ſo as to choak me; till after a ſeven months paſſage we arrived in *Pullicat Road*: from whence we got freſh proviſions, and ſent for men to carry the ſhip to *Madraſs*; where, what remained of the ſick, were got on ſhore to ſick quarters; and where, with freſh proviſions and fomentations of herbs, I got well, and returned on board in eighteen days; where I found a ſtout gang of the country ſeamen, called *Laſkers*, to work the ſhip in her voyage to *China*, and home.

THIS attack of this deſtructive diſeaſe, appeared evidently to proceed from eating two much ſalt meat, and a ſhort allowance of water, &c. I therefore formed a reſolution, as much as poſſible to endeavour to avoid it in future, by eating no more ſalt meat than juſt to give a ſmall reliſh to my bread, or rice inſtead of bread, which we had for eleven months in the voyage. And, at all poſſible opportunities, to get a little *Tea* made for breakfaſt, inſtead of ſalt meat (which increaſed thirſt the whole day) and by that

that means to ſave of the ſhort allowance of water. When we came to *Canton* in *China*, I there ſaw my adopted method of living, in real, general practice; where they cook their animal food, highly ſeaſoned, in ſmall morſels and only take one of them at once, into the mouth, which is nearly filled with boiled rice) and drink tea afterwards, without ſugar, to digeſt it.

IT has been my cuſtom, ever ſince, to drink tea twice a day, when I could get it. And to let lovers of tea know I have had it made in a very nice manner, on board a ſhip, where there were no tea utenſils; I will inform them that it was by putting the tea into a quart bottle, filled with freſh water, corked up, and boiled in the ſhip's kettle along with the ſalt beef. When it came out it was as fine drawn tea, as ever I ſaw. It may afterwards be ſweetened, at pleaſure, in the ſame bottle; and, with ſomething to eat, may be given to ſick people in bed, to bite and ſup, in ſtormy weather, when tea pots, cups and ſaucers, and other means cannot be uſed with ſafety. No doubt coffee may occaſionally be made and uſed at ſea in the ſame way.

WITH the above propoſed method of living, I kept clear of the ſcurvy during the reſt of the voyage, when many of my ſhipmates died with it; and except theſe diſorders here mentioned, I have ever ſince, through providence, enjoyed an uncommon ſhare of health, to my ſeventy ſixth year. In this voyage we had inſtances to prove, that a ſufficient allowance of freſh water, and a little freſh meat, prevented the ſcurvy, and preſerved thoſe alive, that had it longeſt. Our butcher and poulterer, by having water for the Captain's live ſtock, and the offalls from them, I ſuppoſe kept them free from it. The firſt man that took it, was a reduced ſhip maſter, that happened to be the Captain's townſman, who ſent him a plate of freſh meat every day from his table, which prevented the diſeaſe from increaſing upon him for above four months, and which certainly ſaved his life.

BUT to preſerve the health and lives of ſeamen through all the different climates and extremes of heat and cold, we muſt have recourſe to the immortal character of Captain *Cook*, mentioned page 6; who explored the world and fixed its geography in a much more perfect manner than was ever done before; and preſerved the health and lives of his ſhips crews in ſo extraordinary a manner for ſo long a time in unexplored ſeas, both North and South, as far as the ice would admit, as hardly could be equalled in the ſame number of perſons in any part of the world: And who may be

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ſaid to have died gallantly on his duty, by being too anxious to prevent the effuſion of human blood.

ON THE MEANS OF RECOVERING DROWNED PERSONS.

IN the year 1773, an inſtitution took place in *Liverpool* for this laudable purpoſe: and the following are the printed directions which are diſtributed and fixed in and about ſuch places as where the accident is moſt likely to occur.

RULES.

" THE drowned body is to be taken as expeditiouſly as poſſible into the firſt convenient place at hand; and in carrying it, care muſt be taken not to let it be bruiſed, nor hauled roughly, nor carried with the head hanging downwards, nor rolled, nor lifted up by the heels, if it can be avoided, as ſuch uſage often deſtroys the little life remaining. It ſhould be carried carefully, in a natural, eaſy, poſture, (the head raiſed a little,) on a board, window-ſhutter, or ladder between two perſons."

" II. *In the houſe*, the body ſhould be immediately wiped dry, and placed in a *moderate* degree of heat, in a warm bed, blanket or jacket. Bottles of hot water, or hot bricks, wrapped in cloths, ſhould be put to the ſides, the bottoms of the feet, under the hams and arm-pits; warm clothes put about the head; and a warming-pan, not too hot, ſhould be rubbed over the body, and particularly along the back. Warmth may alſo ſometimes be procured, by putting the body into moderately-warm aſhes, grains, ſand, ſteam, or water, if at hand; or in bed by the ſide of a healthy perſon; or in the ſkin of a beaſt newly killed. The windows and doors ſhould be left open, and as few perſons as may be, remain in the room; ſince pure air is of the greateſt neceſſity."

" III. *Warmth being applied thus*, as ſoon as poſſible, the next things to be done are: firſt, to blow with force into the lungs, by applying the mouth to that of the unfortunate perſon, cloſing his noſtrils with one hand, and gently preſſing the cheſt with the other, ſo as to imitate the ſtrong breathing of a healthy man. For the ſake of cleanlineſs, a cloth may be put over the mouth whilſt this is done: ſecond, At the ſame time, the ſmoke of tobacco ſhould be thrown up into the bowels by means of a pipe, ſheath, bellows, fumigator,

fumigator, or other fit inſtrument, and the belly ſtroked and preſſed gently upwards: third, The head, belly, breaſt, ſides, back and arms, ſhould be well rubbed with a coarſe cloth or flannel (or a fleſh bruſh) ſprinkled with brandy, rum, gin, hartſhorn, or with fine dry ſalt; and hartſhorn muſt be put up the noſtrils, and rubbed upon the temples frequently.---The body ſhould now and then be well ſhaken, and its poſition altered. The mouth ſhould alſo be cleanſed from flime, by a bruſh or feather."

"III. When there are any ſigns of returning life, ſuch as ſighing, gaſping, twitching, beating of the heart, or the return of the natural colour or warmth, a vein may then be opened in the arm or neck, but not an artery; the taking away much blood doing great hurt. Nor is bleeding in all caſes neceſſary or proper, unleſs, after ſigns of life appear, a viſible oppreſſion requires it.---With a feather, tickle the throat to cauſe vomiting; and the noſtrils, and give ſnuff, to provoke ſneezing. Give a tea ſpoonful of warm water now and then, to try if the power of ſwallowing be returned: when it is, give a meat ſpoonful of warm wine, or water with a little brandy or ſpirit of hartſhorn, but not before, leaſt the liquor ſhould get into the lungs, and ſuffocate.---All theſe methods ſhould be continued with vigour, two hours, or more, even though no ſigns of life appear, or till it be gradually reſtored; a ſpeedy recovery being very ſeſdom to be expected.---The frozen muſt be firſt rubbed with ſnow, or ſpunged with cold water, till unfrozen, and then gradually brought into warmth, and aſſiſted with other means."

I HAVE been induced to inſert the above, as by diligently purſuing theſe rules, many valuable lives have been, and I make no doubt but many more will be ſaved, to the great benefit of themſelves, their families and the public.

THOSE who occupy their buſineſs in great waters are frequently liable to accidents of this ſort, and ſurely none of them would be ſlack in their endeavours to reſtore a brother ſeaman to life. Let every one conſider how ſoon, and how eaſily, it may be his own caſe; how dreadful it would be for him to be ſuddenly ſnatched away, in the midſt of a careleſs, and thoughtleſs, if not a vicious life;---and what a bleſſing he ſhould conſider it is, by any means, that life ſhould be reſtored to him, which he might afterwards employ in the ſupport and maintainance of a family whoſe bread depended upon his labour, and in a conduct ſo decent and regular, as might lead him to hope for the future mercy of Heaven.

I ONCE had the pleaſure of taking up one of my ſeamen from under water, and to all appearance drowned; but by our exertions recovered him; and the firſt words he was able to ſpeak (perceiving me buſy about him) were "my dear Captain pray for me." To which I replied, that as he was now in a fair way of recovery, I hoped he would be able to pray for himſelf, and be thankful to providence for his narrow eſcape.

THE public is much indebted to my late worthy and benevolent friend Dr. *Houlſton*, for the active part he took in promoting this Inſtitution. And I take this opportunity of acknowledging the obligation which I have been under to him for his aſſiſtance, while his health permitted, in the reviſal of this treatiſe.

ON A MARITIME ACADEMY FOR LIVERPOOL.

A MARINE Society for the relief of diſtreſſed maſters of ſhips, and their families, has lately been happily eſtabliſhed here, and is now, to all appearance in a proſperous ſtate. Much, however, ſtill remains to be done for the encouragement of that uſeful body of men, who devote themſelves to the ſea ſervice. A Maritime Academy, or School, for the proper education of thoſe who make choice of this way of life, would certainly prove of great public utility, and conduce in a very important degree to the improvement and ſecurity of our Marine.

LIVERPOOL has not at preſent any eſtabliſhment of this kind, though the nature of the port renders it particularly wanted, and eſpecially for the training of Pilots. A moment's reflection on the important charge depoſited in the hands of the people of this profeſſion, will put beyond a ſingle doubt, the great advantages which would certainly ariſe from the adoption of ſuch a meaſure. The neighbouring nations, our competitors in arts and arms, and particularly that kingdom which ſtands forth the moſt dangerous rival in our manufactures, commerce, and naval power, have Maritime Academies in all their principal ſea ports, to train their youth deſigned for ſea officers, in the theory of ſuch arts and ſciences as are deemed a proper foundation for their intended profeſſion. Self defence then requires us to aim at equal perfection, by uſing equal means for its attainment. When boys have acquired ſuch a degree of general knowledge as the ſcools commonly afford,

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there ſtill remains much to be done to prepare them for the particulars to which they are deſtined; and in no one line of life is ſuch preparation more eſpecially requiſite, than towards forming a complete ſeaman. There is certainly an extenſive field for improvement in conſtructing working and managing ſhips to the greateſt poſſible advantage. The ſafety and ſucceſs of this inſular empire---the wealth, health, and happineſs of every individual member of it, depend much upon a due cultivation of thoſe natural advantages we enjoy from ſituation, but call for further and require the utmoſt aſſiſtance of art. Amidſt the numerous improvements now going forward in this thriving ſea port, let it not be ſaid that our woodenwalls are neglected and forgot.---Permit then a ſincere friend to the welfare of this town, to recommend an attempt towards eſtabliſhing the following ſcheme.

LET us endeavour to begin with an Academy for twenty youths, who are already able to write a legible hand, are maſters of common arithmetic, and are intended for ſea officers, or for pilots. A building for this purpoſe would be very advantageouſly ſituated on the banks of the Merſey, as near to and directly facing the preſent channels into this port as circumſtances will allow; in ſuch a ſituation, the theory and practice of ſeamanſhip may be acquired with much more eaſe and to a far greater degree of perfection, than by any method hitherto adopted. What is now a taſk and perhaps an arduous one to many, may hereby be rendered not only eaſy but a pleaſure both to the maſter and ſcholar. They will here enjoy the ſuperior advantages of ſeeing and obſerving without interruption, many thouſands of veſſels, of various nations, different in their conſtruction, rigging and burden, from a thouſand tons downwards, conducted to and from ſea, through the many difficult, dangerous, narrow, ſhifting, channels, amidſt the numerous and extenſive ſand banks, as may be ſeen in the Chart of our Harbour, which interrupts the enterance into it, and where rapid croſs tides run, even in the River, which require the moſt perfect ſkill of the Pilots, in conducting ſhips through ſo many perils with ſafety, according to their draught of water, and the ſtate of the tides, over our ſhoal bars, where the waves of the ſea often run high, all which require the utmoſt exertions of the ſhips officers and their crews, to get the neceſſary duty done as occaſions point out.

THE good or bad conſequences attending the different modes of management, may here be noted by the tutor, and pointed out to the pupils. He may illuſtrate what is paſſing before their eyes,

and if any new and uſeful hints in the conduct of theſe ſhips, that vary from, and may add further improvement to the rules publiſhed on Practical Seamanſhip, they ought to be particularly noticed and made public, to make them as perfect as poſſible.

AFTER about three years ſtudy in the Academy, an apprenticeſhip in the merchant's ſervice, or in that of a pilot, will be the beſt mode of finiſhing the education of a ſeaman.---Practice makes perfect; the more difficult and dangerous, the navigation they are accuſtomed to, the more expert and dexterous will our ſeamen become. In rapid croſs tideways, and narrow channels, the ſkilful ſailor not only gives ſecurity to his own ſhip, but is enabled in a thouſand inſtances, to hurl deſtruction on his country's foes.

THE patronage of ſome gentlemen of weight and conſequence would be peculiarly ſerviceable, to recommend, protect and encourage this uſeful plan. If a beginning was once made and the inhabitants of this flouriſhing port thereby led to conſider the ſubject with attention, the utility and neceſſity of ſuch a ſeminary would ſo clearly appear as to ſecure its further progreſs.

SUCH preparations have already been made, that a regular plan may be eaſily formed from them, if the hints, now ſubmitted to general notice, are judged deſerving of public encouragement.

IN travelling through *France*, in 1749, their ambitious views might eaſily be ſeen, by their endeavours to ſpirit up their people; I obſerved ſeveral ſtone pillars were erected with a Globe on their tops, with the *French Arms* painted all over them. And that famous Stone Statue at *Paris*, repreſenting *Louis* the 14th, with the four quarters of our Globe in Human Figures chained to his Pedeſtal, cauſed me to enter into an Antigallican Society in *London*; ſince that time they have been taking all unfair advantages againſt us, by ſeducing the other great Maritime powers to join them, by which we loſt our *American Colonies*, and the immence expence they have been at, and ſtill continue carrying on, to make an Artificial Harbour at Cherburg, big enough to hold their whole Navy, oppoſite to the *Iſle* of *Wight*, to all appearance is deſigned againſt us.

ALL theſe reaſons, I hope will prove the neceſſity there is to have Maritime Academies in all the principal ſea ports in *Britain*, and eſpecially where the moſt eſſential parts of Practical Seamanſhip can be ſeen, in the working and managing of ſhips through dangerous narrow channels and croſs tide ways, as has been

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mentioned at *Liverpool*, where I have been long endeavouring to get one eſtabliſhed, and according to my circumſtances would gladly contribute ſomething handſome towards getting it forward. I have wrote ſeveral pages of hints which I think might be uſeful towards its regulations, but it would anſwer no purpoſe to publiſh them till they come into uſe, which I hope will be ſoon.

I ALSO take the liberty to recommend another at *North Sheilds*, where the upper Light-Houſe ſtands, where the extraordinary dexterous management of the coal ſhips going out and in, as mentioned page 130, is to be ſeen.

AND another at *Lime-Houſe*, *London*, where not only theſe coal ſhips, but vaſt numbers of fine capital merchant's ſhips might be ſeen navigating cloſe paſt this Academy, up and down the river, turning to windward in very little room, and where there is not room to turn to windward, drive with the tide againſt the wind through the ſhoal and narrow part of *Deptford Reach*, and in the *Pool* through greater crowds of ſhips, than is to be ſeen in any other part of the world, and all the moſt eſſential practice in the management of ſhips driving againſt the wind in very little room, which certainly makes ſuch ſituations as theſe mentioned to learn the art of Seamanſhip, much preferable to that of *Chelſea* where neither ſhips nor ſea is to be ſeen.

THESE hints being given towards preſerving the health of ſeamen's bodies, I hope to be excuſed taking the liberty, from experience and obſervation, to offer ſome hints that may contribute to preſerve the health of their ſouls, which have to govern and conduct their bodies through all temptations and troubles they are liable to in their paſſage through this our world, where we are placed in a wonderful order as probationers for a limited uncertain time, and as head and ſupreme actors therein; not only to be beholders and obſervers of all the glorious works and infinite wiſdom of the ALMIGHTY's creation in and about us as men, as mentioned page 120, how our world with its neceſſary attending moon his kept revolving miſteriouſly in ſuch exact order as to produce regularly days and nights and different ſeaſons for the productions of the vegetable and animal creation, ſo boun-

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tifully for the uſe, but not for the abuſe of men, but that we might attribute as juſtly due, all the prayer, praiſe, adoration and thankſgiving we are capable of, by uſing our utmoſt endeavours to fear, honour, and love GOD, by keeping his commandments according to chriſtian principles and precepts as recommended in the following Concluſion.

I ſhall now at the Concluſion, beg leave to propoſe one farther conſideration to the ſerious attention of my Brother Seamen, however unſuitable it may appear to a ſubject of this kind, or to the profeſſion or qualifications of the writer. I could wiſh to impreſs upon their minds a deep conviction of this great truth, that our own utmoſt ſkill, caution, vigilance, and dexterity, are altogether inſufficient of themſelves to command ſucceſs in our proceedings, or preſerve us from the many dangers and difficulties we are expoſed to, without HIS all powerful protection and aſſiſtance, whome the winds and waves obey.-----*Unleſs the Lord keep the houſe (or Ship,) the Watchman waketh but in vain.*-----It is the Almighty Author of nature alone, who form'd the univerſe, and is preſent to all the parts of it, urging or reſtraining the elements, promoting or obſtructing the deſigns of men according to the allwiſe and beneficient purpoſes of his government, upon whom our ſucceſs, happineſs and preſervation intirely depend.

How diligently then ſhould we ſtudy and endeavour, by the uſefulneſs and piety of our lives, to recommend our ſelves to his favour and protection, and religiouſly implore his direction and aſſiſtance in all our undertakings;---knowing him to be our only *ſure guide*, our only *certain help in time of need*.

AND we may be likewiſe aſſured, that it is the perſuaſion alone, and the conſciouſneſs of having endeavoured to regulate our lives according to his divine Will, that can afford rational happineſs in the moſt proſperous circumſtances, or inſpire us with true courage and conduct in dangers and difficulties.

THE virtuous and religious man, confiding in his GOD, will, when his duty calls, face Death itſelf undiſmayed, having nothing to fear, but much to hope from it;---whilſt the impious and wicked upon the firſt appearance of danger are often ſtruck with ſuch panics, as incapacitate them for acting properly for their own ſafety, or that of others, which may unfortunately depend upon their courage and conduct.

IT would be needleſs to enumerate in confirmation of this truth the examples, with which hiſtory both ancient and modern abounds,

bounds, as almoſt every one's own experience will abundantly ſupply them.---Indeed in the ſeafaring life they occur but too frequently, and afford us convincing evidence of the truth of thoſe texts of ſcripture, " that *there is no peace in the wicked, who are* " *like the troubled ſea, which cannot reſt*:---*that they flee, when no* " *man purſueth, while the righteous are bold as a lion.*†---

BUT though our preſent as well as future ſafety and happineſs ſo much depend upon a good, uſeful, and holy life, yet ſuch is our deſparate and amazing depravity, that inſtead of rendering due honour and adoration to the Divine Being for his manifold gracious deliverances;---inſtead of invoking his aſſiſtance in dangers and difficulties, how often do we ungratefully blaſpheme his all ſacred name by profane curſing and ſwearing.

How ſtrange it is that Sailors, whoſe preſervation ſo viſibly depends upon the providential care, which they almoſt daily experience,---who are, as it may be juſtly ſaid, but an inch breadth from eternity;---that they, more than any other claſs of men, ſhould be almoſt perpetually daring the Divine vengeance by this moſt unaccountable vice? A vice of all others moſt irrational, which

† The moſt ſtriking proof I ever met with of this was in a tyrannical, impious, ſelf-ſufficient commander of a ſhip in the *Jamaica* trade, under whom I ſailed; who openly made a mock of all religion, profeſſing in his converſation, that he was under no concern about it; that with a conſcience (as he termed it) void of offence, a man might make himſelf very eaſy, and the like. But ſo far was he from this happy ſtate, that to extinguiſh thought and reflection, he was almoſt conſtantly adding more guilt to his painful and troubled mind, which made him viſibly a Hell to himſelf, and the ſhip like a Hell a float to all on board under his command; ſpending his time at ſea moſtly in exceſſive drinking, gaming, quarrelling, abuſing, and ill-uſing ſome part of his crew, even to breaking limbs, and endangering their lives. At the firſt of the voyage the officers that refuſed to join him in his follies were called mean ſpirited fellows, &c. and ordered up to the maſt-head in rainy weather, for a puniſhment, to look-out during his pleaſure.

He would damn an officer, and aſk why he did not give the ſeamen ſugar plumbs, only for calling them by their proper names. He deemed it an act of piracy for the officers of the watch to offer to lower or take in ſail, or bear away from the courſe in heavy ſqualls of wind, though in the open ocean, and neceſſity might require it for the ſafety of the whole, but he muſt be called upon deck to take the command; and being commonly pot valiant, rather than be obliged to lower or take in ſail, in ſqualls upon a wind, would cun and run the ſhip right before the wind, and carry ſail till ſhe was ſo overpreſſed, as to loſe power of the helm to command her.

Thus this over-bearing ſelf-ſufficient Hero thought to outbrave all the power of ſtorms, difficulties, and dangers without damage; but it proved otherwiſe, for we met with ſuch, and ſo many, diſaſters, that once the general outcry of the ſeamen was to out boats and quit the ſhip; when this boaſting Hero was deſired to exert his authority to ſtop the people from it, he then tyrant like, loſt all his boaſted courage, fell a crying like a child, and begged his officers to take the command and ſtop the ſeamens proceedings, which juſt ſaved the ſhip, but not without great damage.

We were well armed for war againſt the declared enemies of our country, but our commander had the worſt of enemies, a guilty conſcience, within himſelf; for when quarrelling with one part of his officers, the other were called up from ſleep in the night, to get the ſmall arms fired off and ſecured, to prevent, as he ſaid, the ſhip being taken from him.

It would be too much to relate the many great troubles this unhappy man brought upon himſelf in this voyage; and the next was his laſt, for he was never heard off after he departed from home.—I have been prolix upon this miſerable character, that it may be a warning to others, who wiſh for ſucceſs and happineſs, not to follow his example.

which can offer neither pleaſure nor profit to tempt us to the commiſſion of it, nor urge in its vindication, what ſome other vices may, a natural propenſity: "For no man, as Archbiſhop *Tillotſon* juſtly obſerves, "can plead that he was born with a ſwearing conſtitution."

OFFICERS ſometimes juſtify this wicked practice under a pretence that their orders would not be ſufficiently regarded, unleſs enforced by ſwearing.---Idle and vain pretence! as upon trying a different conduct, I am perſuaded, they will be ſoon convinced.---From my own obſervation and experience I can aſſert, that in critical emergencies, when the leaſt delay would be fatal to the whole, and neceſſity requires every one to exert his utmoſt, any ſort of ſharp words or threats uttered with an angry tone,* telling the men the neceſſity for their activity, and how much depends upon it, will have a better effect than vulgar oaths, which from being ſo frequently heard become no more regarded by them than common words;---they having from example and daily practice learned to ſwear as profanely as their officers.

THE ſhameful prevalence of this vice amongſt us, and the infectious influences of ill example, are but two evidently ſeen from this, that the inferior ſort of foreigners, who have much converſation with us, generally acquire this common ſwearing part of our language firſt:---A melancholy proof that they hear it moſt frequently,---and are perhaps moſt inclined to imitate it.

How highly incumbent then is it upon officers and thoſe in command always to diſcountenance this vicious practice by their own example; as no reformation without this can be expected;---eſpecially if they reflect that the more exalted a man's ſtation is, the greater his crime; as its influence is more pernicious: And ſince *many a fruitful and flouriſhing land has been made barren for the wickedneſs of its inhabitants*, every impious and profane man ought to be deemed and treated as the greateſt enemy to his country.

BUT I indulge the pleaſing hope, that a reformation will now be ſoon produced by the virtues of our preſent moſt amiable Sovereign, in whoſe bright example we ſee piety, morality, and obedience to the laws of GOD and his country ſtrongly recommended.---And I would hope, that his wiſhes expreſſed in his firſt moſt excellent Proclamation, are not only publickly read in all his navy, as often as the articles of war, but alſo enforced, to check the immorality and profaneneſs, which has too long prevailed amongſt ſeamen, of all ranks and degrees.

* Calling them inactive lubbers, and the like.

AND

AND in order to promote this good end, which every one, who has the intereſt of his country at heart, will endeavour as much as lies in his power, I would earneſtly recommend it to all commanders of ſhips to have a reaſonable part of Divine Worſhip publickly performed on board every day, or as often as conveniently may be; ---which, to our ſhame be it ſpoken, is often, even in our large † *Eaſt-India* ſhips, ſcandalouſly neglected.

THIS, I think, I can ſay from profitable experience, contributes greatly to produce good order, harmony, and piety on board, and check diſorder, vice and immorality of every kind,---even amongſt the moſt diſſolute and ignorant in privateers, as well as merchant's ſhips.

No rational Being ſurely can want exortation to this moſt reaſonable and bounden duty:---For *man*, the only animal in the creation ſo diſtinguiſhingly favoured,---endowed with faculties to contemplate the glorious works of the creation, and enjoy his portion of the good things thereof with gratitude to the great Creator, and benevolence to his fellow creatures,---for *man*, I ſay, to want piety and religious veneration is worſe than brutiſh.---For *man*, bleſſed with the lights of the Goſpel to direct him in his duty, to reform, improve and qualify his nature for higher enjoyments,---pointing out to him, what is moſt conducive both to his preſent and future happineſs, to renounce theſe high privileges, and blindly wallow in ſenſuality---is truly monſtrous.

BUT after all,---though our religion lays no reſtraints upon us, but ſuch only as promote our preſent happineſs, both as individuals and members of ſociety,---yet ſuch is our miſerable frailty, and ſo many, various and powerful are the enemies and temptations we have to contend with in our courſe, *that of ourſelves*, as we have deploreable conviction from daily experience, *we cannot but fall.*

WITH what humble gratitude then, what ardor of affection and adoration ſhould we embrace the *great Salvation* revealed in the Goſpel, procured and purchaſed for us at ſo dear a price and in ſo myſterious and ſtupendous a manner!---and *freely* offered us, who

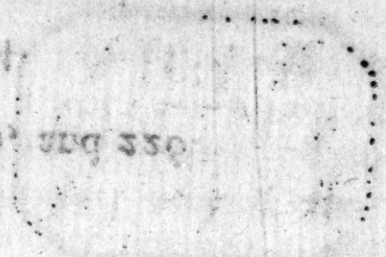
† For the firſt fifteen years that I was at ſea, in different trades, I never ſaw any religious duty publickly performed on board, except that in an *Eaſt-India* ſhip, for two or three *Sundays*, when we drew near the *Cape of Good Hope*, we had prayers, which ceaſed after we paſſed the *Cape*.—Does not this indicate that the fear of approaching danger was the motive, and not a grateful ſenſe of thoſe inceſſant benefits, we are conſtantly receiving?——Indeed that great company, or their managers, are highly blameable in ſhamefully rating thoſe large ſhips only at 499 tons, in order to evade the expence of a Clergyman, and the penalty of the law for not carrying one.——It would be well for them to conſider, that acting upon chriſtian principles is the only true policy; and that ſchemes upon any other principles, cunningly deviſed, for accumulation of wealth, may, and moſt likely will in the event, prove unto them *only an occaſion of falling.*

ſtand ſo much in need, and are ſo wholly unworthy of it! What *diligence* ſhould we uſe,---what holineſs ſhould we aſpire after, to inſure to ourſelves an intereſt in this grand ATONING SACRIFICE! And how devoutly ſhould we implore the promiſed aſſiſtance of *his aiding and ſanctifying grace* to conduct us ſafe through this tranſitory voyage of life, to a bleſſed and happy eternity.

LET us then, under the direction and guidance of this great AUTHOR and CAPTAIN of our SALVATION, our all glorious REDEEMER, CHRIST JESUS, purſue our courſe with ſteadineſs and reſolution, and fight manfully under his banner, ---looking up to him for ſuccour in all our diſtreſſes and difficulties, who is powerful in Heaven and Earth, and will never forſake or reject thoſe, who ſincerely love and truſt in him.---To whom be glory for ever. *Amen.*

FINIS.

MVSEVM BRITAN NICVM



REFERENCE to the PLATES.

THE front Plate, page 53.

Plate 1ſt, pages 21, 33, and 38.

Plate 2d, pages 82, and 247.

Plate 3d, pages 74, 75, 87, 94, and 138.

Plate 4th, pages 100, and 103.

Plate 5th, pages 75 97, 135, and 138.

Plate 6th, pages 68, 163, and 165.

Plate 7th, pages 86, and 175.

Plate 8th, page 229.

Plate 9th, pages 206, and 226.

Plate 10th, page 194.

Plate 11th, pages 212, and 224.

Plate 12th, pages 18, 57, and 257.